lake winnipeg, churchill & nelson rivers study board
CANADA
MANITOBA
1971-'75

wildlife studies

technical
report
appendix
6

LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD

APPENDIX 6 - WILDLIFE STUDIES

A - WILDLIFE RESOURCE IMPACT ASSESSMENT - LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS HYDROELECTRIC PROJECTS - No. 1 - OUTLET LAKES

B - WILDLIFE RESOURCE IMPACT ASSESSMENT - LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS HYDROELECTRIC PROJECTS - No. 2 - SOUTHERN INDIAN LAKE

C - WILDLIFE RESOURCE IMPACT ASSESSMENT - LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS HYDROELECTRIC PROJECTS - No. 3 - LAKE WINNIPEG, LOWER CHURCHILL RIVER, RAT-BURNTWOOD DIVERSION

WILDLIFE RESOURCE IMPACT ASSESSMENT
LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS HYDROELECTRIC PROJECTS

NO. 1 - OUTLET LAKES

by

R. WEBB
F. F. Slaney & Company Limited
Vancouver, British Columbia
March, 1973

for

THE LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD

SPECIAL NOTE

THE CONCLUSIONS AND RECOMMENDATIONS CONTAINED IN THIS APPENDIX ARE THOSE OF THE AUTHOR(S) AND ARE NOT NECESSARILY THE SAME AS THE CONCLUSIONS AND RECOMMENDATIONS OF THE LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD AS EXPRESSED IN THE SUMMARY REPORT AND THE TECHNICAL REPORT.

F. F. SLANEY & COMPANY LIMITED

RESOURCE DEVELOPMENT AND ENVIRONMENTAL MANAGEMENT
Cable·SLANEYCO ▲ 402 W Pender Street ▲ Vancouver 3 Canada ▲ Phone 687·0151

March 19, 1973.
File: M 25.

Dr. Ian Dickson,
Study Director,
Lake Winnipeg, Churchill and
Nelson Rivers Study Board,
693 Taylor Building,
Winnipeg, Manitoba.

Dear Dr. Dickson,

It is the pleasure of F.F. Slaney and Company Limited to enclose under separate cover 15 copies of the Outlet Lakes wildlife report as partial fulfillment of our contract signed October 12, 1972.

We have identified the major wildlife issues associated with Manitoba Hydro's development plans and have proposed feasible ways of reducing the impact of detrimental effects.

Sincerely,
F.F. SLANEY & COMPANY LIMITED

R. Webb,
Chief Ecologist.

RW/brf.

▲ FORESTRY ▲ AGROLOGY ▲ FISH AND WILDLIFE ▲ RECREATION ▲ ENGINEERING ▲

ABSTRACT

This report considers wildlife mitigation and enhancement possibilities associated with hydro development program for the Outlet Lakes, and identifies those issues of potential significance. Data were gathered on the region from Lake Winnipeg to Sipiwesk Lake through the processes of aerial surveys of waterfowl and ungulates and assimilation of data from reports, interviews, and personal observations. Some good moose habitat was found to exist in areas that may be affected by water level change. An estimated 50 ± moose could be lost through inundation in the West Channel area from a base population of several thousand animals. The area is currently unimportant to licenced hunters, but may be important to Treaty Indians. Possibly two woodland caribou herds are found in the Outlet Lakes area. Some information is presented on the Norway House herd which supports a licenced hunter harvest of 10 - 15 animals per annum. Treaty Indians take an additional 20 animals, approximately. The area supports some breeding Canada geese and several species of ducks. Moderate numbers of Canada geese, lesser scaup, mallards and other ducks utilize the region in fall. Greatest numbers were at Duck Lake, Cross Lake, and Playgreen Lake. The fur resource is important to the residents of Norway House and Cross Lake. Approximately 400 people trap within the registered trapline system. The 1970 - 1971 fur return was approximately $60,000. Increased access will improve the harvest of moose, caribou and waterfowl. A number of wildlife issues were identified and possible mitigation practices discussed. Wildlife issues identified as most significant were loss of trapping potential, waterfowl habitat disturbance, moose habitat loss, and increased harvest rates for big game close to settlements.

SUMMARY

RECOMMENDATIONS

Wildlife issues identified as most significant were:

1. Cross Lake loss of trapping potential.
2. Cross Lake waterfowl habitat disturbance.
3. West Channel moose habitat loss.
4. West Channel loss of trapping potential.
5. Eight Mile Channel waterfowl habitat loss.
6. East Channel loss of trapping potential.
7. Increased harvest rates for big game close to settlements.

Recommended procedures for lessening impact upon wildlife are as follows:

1. Provide compensation and/or equivalent work alternatives to affected trappers to equate with loss of trapping income - Cross Lake, West Channel, and East Channel.
2. Determine optimal water level regimes through the medium of ad hoc committee and special studies as required - Cross Lake, Kiskitto Lake, and East Channel.
3. Remove standing timber on the new shorelines of islands in Cross Lake and above the new high water level of the West Channel.
4. Contain the dredge spoil on the west side of the Eight Mile Channel. and develop goose and duck nesting habitat.
5. Establish management procedures to regulate moose and caribou harvests around communities and camps.

6. Revegetate spoil and excavation areas to control erosion.
7. Protect or create habitat by leaving nesting trees for ospreys and eagles, and windrowing cut trees and slash.
8. Implement acceptable incineration methods for garbage around camps.
9. Establish floodline contours for Cross and Kiskittogisu Lakes.

OBJECTIVES

The report identifies wildlife issues associated with hydro development and considers wildlife, mitigation and enhancement possibilities for the Outlet Lakes.

TERMS OF REFERENCE

F. F. Slaney & Company began work on wildlife resource studies August 15, 1972. Slaney employees were to assist the Study Director and Study Board on wildlife matters.

THE STUDY AREA

The location, climate, geology, topography, drainage patterns, and vegetation of the Study Area are described. The climate is Boreal-Arctic. Most of the Study Area is part of the Severn Upland of the Pre-Cambrian Shield physiographic region. Topography is influenced by bedrock modified by surficial materials deposited during the Wisconsin ice age and subsequent peat accumulations. The Outlet Lakes carry water from a 380,000 square mile watershed. Approximately 18 to 20 percent of the flow from Lake Winnipeg drains through the East Channel and the remainder through the West Channel.

Forest vegetation is of the Nelson River Forest section of the Boreal Forest. Black spruce-feathermoss communities are climax on 90 percent of sites. Jack pine and mixedwood stands form successional communities after fires. A fen-tamarack vegetation type develops on poorly drained, mineralized soils. Marsh vegetation along shorelines features bulrushes, sedges, and pondweeds. Basic marsh ecology is described. Shoreline types as classified by Newbury, 1973, are briefly described.

METHODOLOGY

East Channel, Kiskitto Lake, and Eight Mile Channel issues have been previously reported upon. Liaison has been carried out with members of the Study Directorate, other Study Board contractors, and provincial and federal personnel.

Aerial reconnaissance surveys were undertaken and data gathered from a number of other sources. Aerial survey flights were made in September and November 1972 for the purpose of determining distribution and abundance of waterfowl and moose.

General wildlife observations were related to shoreline types and to habitat classifications of the Canada Land Inventory Program. Water level information obtained from Hydro was considered to have certain effects on the physical environment. Major wildlife involvements were then deduced and listed in the report. Possible mitigation procedures were outlined and discussed. Those key issues and related mitigation requirements considered most important were isolated and presented as recommendations.

OBSERVATIONS AND CONCLUSIONS

Moose and woodland caribou habitat requirements, numbers and distribution, and utilization by humans, are discussed in detail.

Cross Lake, West Channel and Upper Playgreen Lake support greatest amounts of shoreline important to moose. Class 2 habitat identified by the Canada Land Inventory system occurs primarily along rivers and lake shorelines of Cross Lake, West Channel and Upper Playgreen Lake. In the West Channel (Jenpeg forebay area) there are 26.3 square miles of Class 2 moose habitat, 5.1 square miles of Class 3 habitat, and six square miles of Class 4 habitat. A moose density of approximately .6 animals per square mile was determined in November, 1972 for the forebay area. This density is comparable to those obtained by provincial wildlife employees in other parts of northern Manitoba. Majority of moose sighted were within 200 yards of a lake, river or stream shoreline or near the edges of bogs or fens. The allowable harvest of moose in the Outlet Lakes region could be as high as 800 animals per year. It is estimated that less than two percent of that figure is currently achieved by licensed hunters. An unknown number of additional moose are taken by Treaty Indians. Inundation of the forebay area could remove as many as 48 moose from the estimated base population of several thousand. Opening of roads to the public will result in increased moose harvests by licensed hunters and also provide additional viewing opportunities. Some local overharvest can be expected around settlements and camps.

It is possible that two herds of woodland caribou - Norway House and Cross Lake - are found in the Outlet Lakes region. Numbers are unknown, but densities are probably light. Good winter habitat exists in the southeastern portion of the area in the form of mature spruce and jack pine stands interspersed with upland bogs. The Norway House herd apparently moves northward in spring to use islands in Kiskitto, Kiskittogisu, and perhaps Playgreen Lakes for calving. Inundation of the 24,000 acres within the forebay will have little effect on available caribou winter range. The Outlet Lakes provides approximately 65-75 percent of the caribou harvest achieved annually in Game Hunting Area 3. From 10-15 animals are reported killed each year. Treaty Indians take an additional 20 animals per year near Norway House. Little is known about the distribution of animals or harvest rates in the Cross Lake region.

Furbearers provide an important part of the economic base of Norway House and Cross Lake residents. Approximately 400 trappers are registered in those two communities. The four most important species are beaver, muskrat, mink and lynx. They constitute about 90 percent of the economic return for the period 1966-1971 inclusive. Economic return to trappers in 1970-1971 was about $24,000 for Cross Lake and $31,000 for Norway House. Muskrats and mink are the two species most closely related to shoreline vegetation. The water regime is important to muskrat production and welfare. Greatly increased water levels or unusual fluctuations may kill vegetation important to muskrats. Reduced levels in winter may cause freezeouts. Beaver habitat is mainly on smaller creeks and channels. That species may adjust to gradually increased water levels. Loss of fur production will be the greatest on Cross Lake, the West Channel, and the East Channel. At Cross Lake 20 Registered Traplines will certainly be affected and another seven might be affected. Approximately 120 trappers could lose some income at Cross Lake. Income losses of lesser magnitudes will occur in almost all other areas.

Significant numbers of Canada geese and ducks, predominantly lesser scaup, use the Outlet Lakes region in the fall. Numbers of Canada geese and several species of waterfowl also breed in the area. Most important fall staging areas within the Outlet Lakes are mapped. Largest numbers of Canada geese were observed on Duck Lake and Cross Lake. Greatest numbers of lesser scaup and mallards were seen on Cross Lake and Playgreen Lake. Some breeding habitat will be lost. Some reduction in fall staging numbers of ducks is expected in the short term but marshes may improve in areas such as Cross Lake.

Greater harvests of waterfowl will occur when access roads open to the public. Since current rates of waterfowl utilization are low for both licensed hunters and Treaty Indians, increases will not likely be detrimental.

A series of actions are proposed to lessen the effect of hydro development on wildlife in various parts of the Outlet Lakes region. They are discussed in detail according to the following classifications:

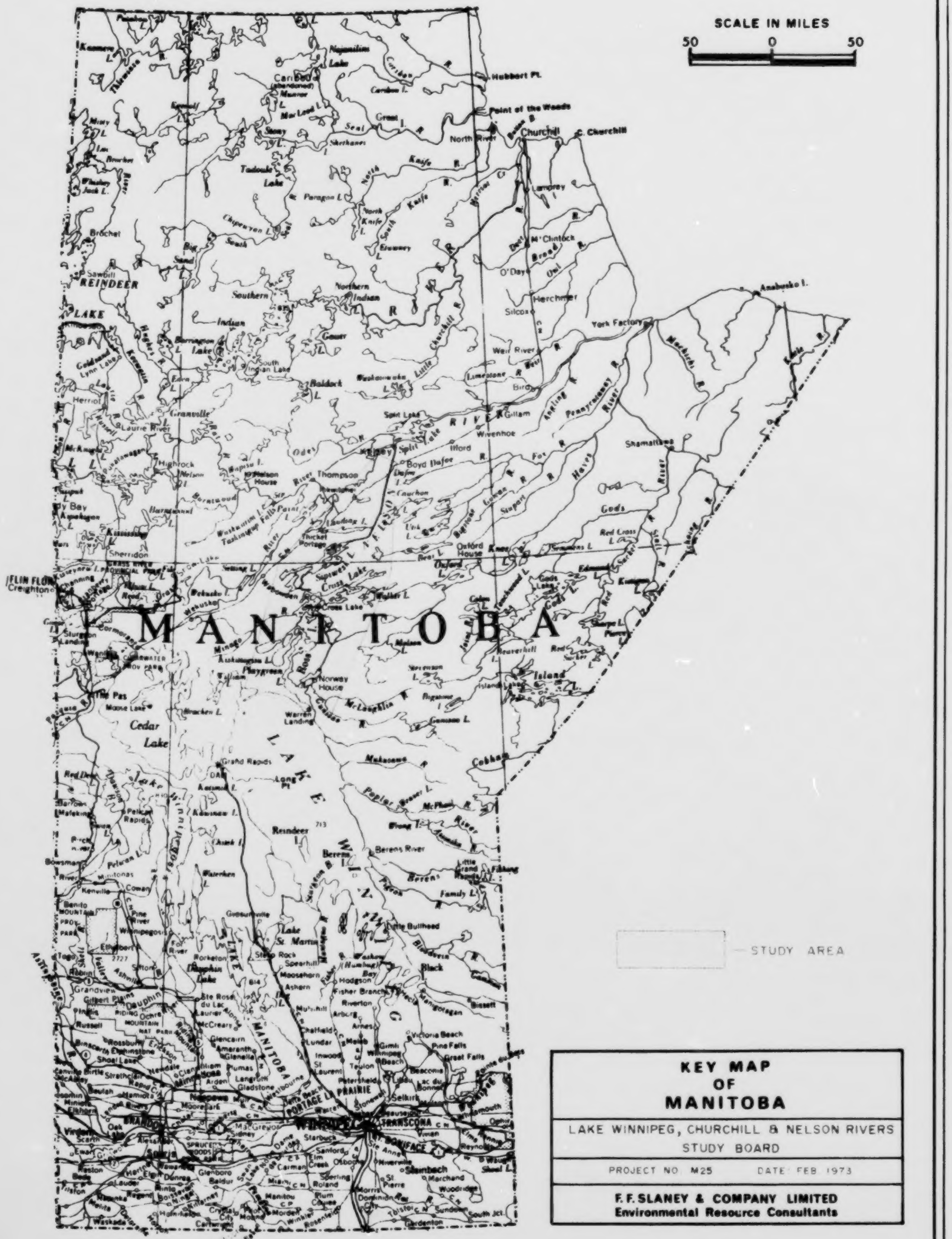
1. Primary alternatives.
2. Modifications of proposed regimes.
3. Determination of optimal water regimes.
4. Trapping losses.
5. Timber clearing.
6. Introduction of food plants.
7. Treatment of dredge spoil.
8. Island construction.
9. Traditional nesting trees for eagles and ospreys.

10. Embayments.

11. Game harvest control.

12. General camp provisions.

Those mitigative procedures that are considered necessary to modify wildlife impacts considered to be potentially serious, are listed within the recommendations section.


SCALE IN MILES
50
0
50
MANITOBA
LAKE WINNIPEG
LAKE MANITOBA
Cedar Lake
Churchill
C. Churchill
Point of the Woods
Hubbart Pt.
York Factory
Gillam
Split Lake
Thompson
Norway House
Grand Rapids
The Pas
FLIN FLON
Creighton
Sherridon
Lynn Lake
Brochet
REINDEER LAKE
South Indian Lake
Southern Indian L.
Oxford House
Gods L.
Island L.
Berens River
Dauphin
Brandon
Portage la Prairie
Winnipeg
Transcona
St. Boniface
Selkirk
Steinbach
Gimli
Riverton
Victoria Beach
Swan River
STUDY AREA

KEY MAP
OF
MANITOBA

LAKE WINNIPEG, CHURCHILL & NELSON RIVERS
STUDY BOARD

PROJECT NO. M25 DATE: FEB 1973

F. F. SLANEY & COMPANY LIMITED
Environmental Resource Consultants

ACKNOWLEDGEMENTS

Many agencies and individuals have contributed to this study. Acknowledgement of each individual is not possible; therefore appreciation is collectively expressed for aid and co-operation received.

Special mention must be made of assistance received from Dr. K. H. Doan, Michael Bilan, Joan Kinniburgh and Tracy Yake, without whose support many reports and statistics would not have been assimilated.

Following is a list of government and private organizations that provided data through reports and direct contact.

Province of Manitoba

Department of Mines, Resources and Environmental Management

- Mines and Departmental Services Division
- Environmental Management Division
- Resources Management Division
- Water Resources Division

Canadian Wildlife Service

Department of Indian Affairs and Northern Development (Winnipeg)

Ducks Unlimited

Study Board Directorate

Staff of the Study Board Directorate provided reports as they became available and otherwise assisted in achieving a standardized approach.

Study Participants

Other study participants shared preliminary information prior to completion of their final reports. Particularly significant to this study was the Newbury et al report on shorelines.

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PART 1

RECOMMENDATIONS

Certain wildlife issues stand out as potentially serious ones that require early consideration of mitigative action. Those issues are discussed in the main body of the report and are identified in this part by section heading. Recommended procedures for lessening impact are numbered consecutively.

CROSS LAKE LOSS OF TRAPPING POTENTIAL

1. Provide equivalent alternatives and/or compensation to affected trappers for loss of income.

CROSS LAKE WATERFOWL HABITAT DISTURBANCE

2. Alter the projected regime so that extreme changes in fall and winter water levels will be minimized.
3. Remove standing timber above spring floodlines around the perimeters of existing and new islands to facilitate the development of a band of grassy or shrubby growth for use by waterfowl and aquatic furbearers.

WEST CHANNEL MOOSE HABITAT LOSS

4. Clear a border approximately 150 feet wide above the new high water level to allow the development of willow or red osier dogwood for purposes of moose browse.

WEST CHANNEL LOSS OF TRAPPING POTENTIAL

5. Provide equivalent alternatives and/or compensation to affected trappers for loss of income.

EIGHT MILE CHANNEL WATERFOWL HABITAT LOSS

6. Ensure the containment of dredge spoil on the west side of the channel.

7. Develop goose and duck nesting islands in the dredge spoil area that will be covered with shallow water in spring and early summer.

8. Blast potholes for waterfowl use in portions of the dredge spoil area that will remain above high water level.

EAST CHANNEL LOSS OF TRAPPING POTENTIAL

9. Consider the primary alternative of not constructing the proposed Sea River Falls dam.

10. If constructed, downstream flows should be regulated to maintain or improve marsh habitat.

11. Provide equivalent alternatives and/or compensation to affected trappers for loss of income.

INCREASED HARVEST RATES FOR BIG GAME CLOSE TO SETTLEMENTS

12. Establish management procedures to regulate moose and caribou harvests in local areas around communities and camps.

GENERAL MITIGATIVE PROCEDURES

13. Leave traditional nesting trees for ospreys and eagles wherever timber clearing is practiced.

14. Leave cut trees and slash windrowed for wildlife habitat wherever timber clearing is practiced above floodline contours.

15. Establish and implement acceptable incineration methods for garbage disposal around camps.

16. Revegetate dredge spoil, dyke and ditch banks, and excavation sites to control erosion wherever that erosion would contribute to lake or channel turbidity.

OPTIMAL WATER REGIMES

17. Establish an ad hoc committee of provincial, federal, Ducks Unlimited Canada, and Study Board wildlife and where appropriate, fisheries, represen[illegible]sider optimal water level manipulative regimes for Ki[illegible] the East Channel, and Cross Lake.

18. On the advice of the committee, establish and carry out studies relating to the determination of optimal water flows and levels for Kiskitto Lake, Cross Lake, and Sea River Falls if time permits.

FLOODLINE CONTOURS

19. Establish floodline contours for Cross Lake and Kiskittogisu Lake.

PART 2

OBJECTIVES

The purpose of this report is to consider wildlife mitigation and enhancement possibilities for the Outlet Lakes and to identify those that would benefit sensitive, important, or critical issues.

Specific objectives were to:

1. Identify the nature and extent of probable effects on wildlife populations, habitats, wildlife resource uses, and wildlife management with emphasis upon critical areas and important considerations.
2. Evaluate the likely effects on wildlife species in relation to their importance to people and to the ecology of the project area.
3. Determine and assess procedures and programs which would prevent, minimize or mitigate against adverse effects on wildlife populations and habitats and those which would maximize enhancement opportunities.
4. As they are identified and determined feasible, recommend mitigation procedures which would require modification in the engineering, design, construction or scheduling of the development project.
5. Develop guidelines for additional study and adjustment to wildlife resource management programs.

TERMS OF REFERENCE

F. F. Slaney & Company were contracted to conduct wildlife resource impact studies for the Study Board. Work began August 15, 1972. Although data collection and field work were immediately initiated for three of the five project subsystems, priority was given to the Outlet Lakes.

F. F. Slaney & Company were to co-operate with other agencies, obtain and evaluate available data, conduct necessary wildlife surveys, define important resource areas with regard to social and/or economic implications, and advise the Study Board on a protem basis. Recommendations were to be made to the Study Board on questions related to wildlife, wildlife habitat and socio-economic implications related to wildlife.

The Study Board was to co-ordinate the various study groups and make all data from the individual groups available at the earliest possible time. Data describing Outlet Lakes soils, vegetation, forests and shorelines were to be provided to Slaney & Company by other Study Board contractors.

Field activities were to be co-ordinated through the Study Board field co-ordinator.

PART 4

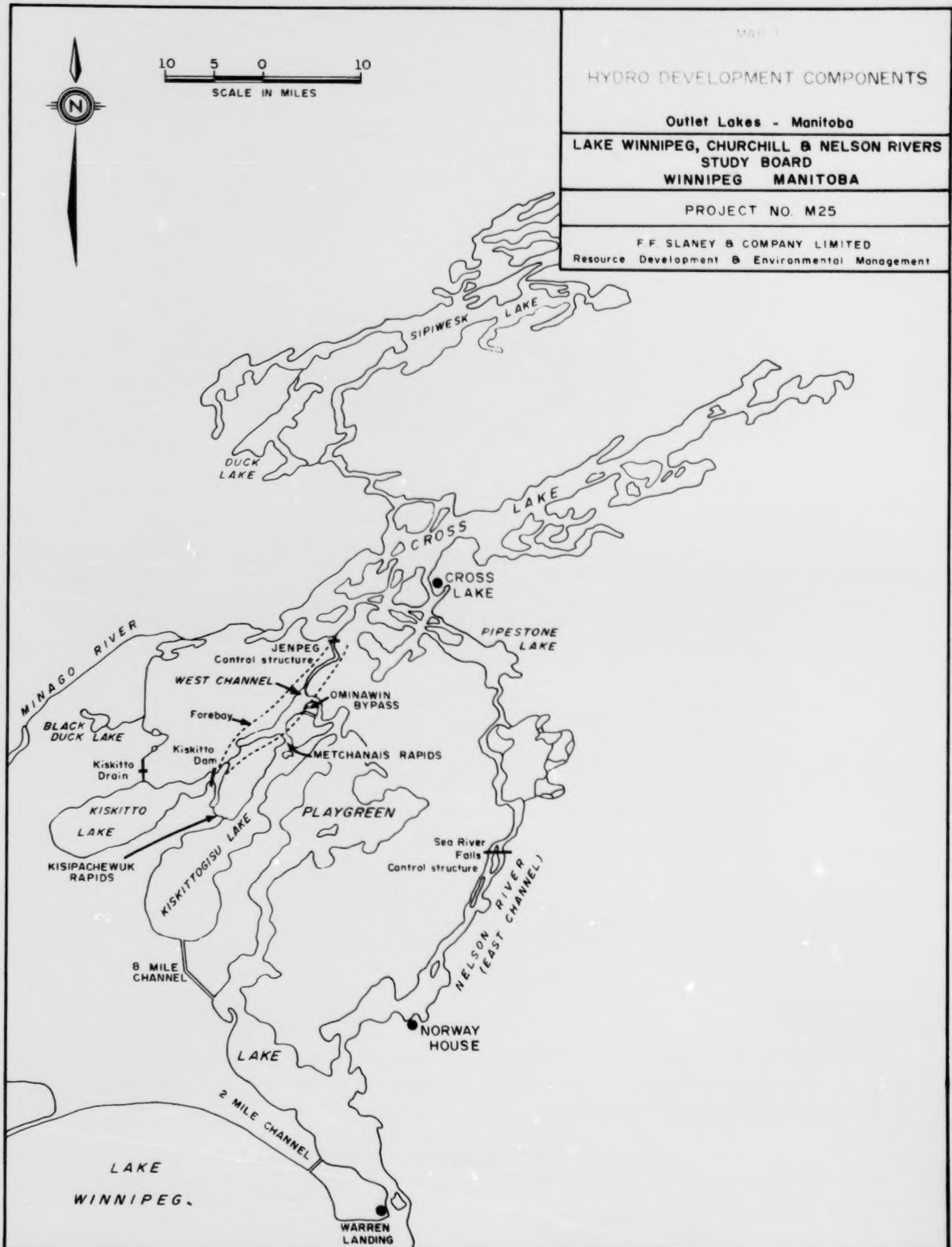
THE STUDY AREA

The area dealt with in this report extends from Warren Landing at the northern end of Lake Winnipeg downstream to the Kelsey Dam on the Nelson River (Key Map). Emphasis was placed upon Cross Lake, the West Channel (Jenpeg forebay), Playgreen Lake, Kiskitto Lake and Kiskittogisu Lake. Additional areas considered were: the lower Nelson River, Duck Lake, the East Channel, Black Duck Creek and Lake and smaller channels. For purposes of this report, the term Study Area applies to the larger area while Outlet Lakes refers to the region from Lake Winnipeg to Sipiwesk Lake (Map 1).

4.1 CLIMATE

The climate of the Study Area is classified as Boreal-Arctic to Boreal moist-subhumid and is characterized by short cool summers and long cold winters. A very gradual climatic change occurs from northeast to southwest with the southwestern portion of the area somewhat warmer (Lamont and Jenkins, 1971a, 1971b, 1971c).

The frost free period ranges from 90 to 100 days and mean monthly temperatures from -10°F in January to 64°F in July (Lamont and Jenkins, 1971a, 1971b and 1971c). Annual precipitation is low, averaging 18 inches, of which about 60 percent falls as rain during the period April to October (Thie, 1972).


10 5 0 10
SCALE IN MILES
N
SIPIWESK LAKE
DUCK LAKE
CROSS LAKE
CROSS LAKE
PIPESTONE LAKE
MINAGO RIVER
JENPEG Control structure
WEST CHANNEL
OMINAWIN BYPASS
Forebay
BLACK DUCK LAKE
Kiskitto Dam
METCHANAIS RAPIDS
Kiskitto Drain
KISKITTO LAKE
PLAYGREEN
KISKITTOGISU LAKE
KISIPACHEWUK RAPIDS
Sea River Falls Control structure
NELSON RIVER (EAST CHANNEL)
8 MILE CHANNEL
NORWAY HOUSE
LAKE
2 MILE CHANNEL
LAKE WINNIPEG.
WARREN LANDING

MAP 1

HYDRO DEVELOPMENT COMPONENTS

Outlet Lakes - Manitoba

LAKE WINNIPEG, CHURCHILL & NELSON RIVERS
STUDY BOARD
WINNIPEG MANITOBA

PROJECT NO. M25

F.F. SLANEY & COMPANY LIMITED
Resource Development & Environmental Management

M.25/M2/

4.2 GEOLOGY, TOPOGRAPHY AND LANDFORMS

Most of the Study Area is part of the Severn Upland assigned to the Superior Province of the Pre-Cambrian Shield physiographic region (Elson, 1966). The southwestern portion borders the northern edge of the Manitoba lowlands but little of it lies within this physiographic region.

Topography reflects the influence of bedrock configuration and its geomorphic history, particularly post-glacial periods. Relief is moderate to slight with elevations ranging between 650 and 800 feet above sea level. Outcrops of Pre-Cambrian bedrock, often exposed but sometimes covered with mineral soil, present a hilly relief on a local scale. Other minor relief features include modified eskers and beaches on the crests of end moraines, usually buried under peat accumulations.

The present distribution of surface materials has been influenced by glaciation during the Wisconsin ice age. Organic deposits, glacial till, lacustrine clays and glaciofluvial sands comprise the surficial material. Following ice retreat, the region was covered by glacial Lake Aggassiz. Wave action and deposition of sediments smoothed the irregular topography and left beach ridges. Subsequent draining caused extensive low lying areas to fill with peat.

4.3 DRAINAGE PATTERNS

Water collecting from a watershed of about 380,000 square miles extending west to the Rocky Mountains, south to the headwaters of the Mississippi River and east to Lake Superior flows through Lake Winnipeg and enters the Study Area and the Nelson River system at Warren Landing. From this point the flow is directly into Playgreen Lake where a division into two channels takes place. Approximately 18 to 20 percent of the flow drains through Little Playgreen Lake, the narrow East Channel and Pipestone Lake into Cross Lake, while the balance follows the West Channel from Playgreen Lake through Whiskey Jack Narrows into Kiskittogisu Lake. From Kiskittogisu Lake three channels (Kisipachewuk, Metchanais and Ominawin) carry water to Kiskitto Lake and the West Channel respectively from which the flow enters Cross Lake to rejoin waters arriving by the eastern route (Map 1).

4.4 VEGETATION

The Study Area lies within the Boreal Forest region and is for the most part within the Nelson River Forest Section according to Rowe's recent classification system. Southern and western parts of the Study Area are within the Manitoba Lowlands Forest Section (Rowe, 1972).

4.4.1 Forests

Black spruce (*Picea mariana*) and tamarack (*Larix laricina*) dominate the most prevalent forest communities. Occurring less frequently are jack pine (*Pinus banksiana*), trembling aspen (*Populus tremuloides*) and white spruce (*Picea glauca*). Balsam poplar (*Populus balsamifera*), balsam fir (*Abies balsamea*), white birch (*Betula papyrifera*) and alders (*Alnus spp.*) are also found (Thie, 1972).

On most sites the black spruce forms climax stands with an understory of feathermosses. Typical black spruce-feathermoss communities can occur on poorly drained organic soils as well as better drained clays, tills, sands and gravels - about 90 percent of the area. Along lakes and rivers mixed stands of black and white spruce are common.

Jack pine stands form successional communities, usually after fires. Such stands are most common on better drained soils where repeated fires maintain the successional status - about 10 percent of all forest vegetation. In areas where fires occur less frequently mixed stands of jack pine and regenerating black spruce are found. Jack pine stand understories are characterized by reindeer lichen (Cladonia spp.), bearberry (Arctostaphylos uva-ursi) and juniper (Juniperus spp.).

In areas of moist lacustrine clays, clay tills and alluvial or glaciofluvial sands, fire successional stands may include trembling aspen and balsam poplar as well as jack pine. The understory is characteristically more diverse, especially in the shrub and herb layers. A mixedwood forest therefore exists over 10 to 35 percent of the Outlet Lakes region.

The vegetation of wet, saturated sites (organic soils) is influenced by nutrients, precipitation, drainage, and fluctuations of ground water and flow. Willow-alder-sedge communities develop on the richer sites which have flowing or fluctuating water. On weakly mineralized soils a ribbed fen-tamarack vegetation type generally develops. Standing water may or may not be present. Sphagum mosses, sedges, dwarf birch and leatherleaf form the ground cover.

4.4.2 Marshes

Marsh vegetation grows along shorelines which possess the required shallow water conditions and suitable sediment substrata for rooting of emergent and submergent species. Newbury (1973) reports these areas are characterized by emergent stands of _Scirpus spp._ in an offshore band, with _Carex spp._ forming an inner band at the water-shoreline interface. _Potamogeton spp._ and _Lemna spp._ occur as submergent and floating members of the more extensive marsh communities.

Factors relating to the formation and retention of these marshes are presumably closely tied to timing and extent of water level fluctuations, as reported elsewhere in Manitoba (McLeod et al, 1951).

Initial establishment of most marsh plants occurs during low water levels when seeds germinate on warm, moist exposed mudflats. Given an exposed period of at least a month seedlings become established through rapid vegetative reproduction and growth and can withstand flooding. Growth continues after flooding but is eventually limited by the availability of a number of soil (bottom sediment) nutrients, especially nitrates, made available during exposure by aerobic decomposition. After lengthy flooding these nutrients become used up and degeneration of the marsh ensues. Open water conditions may result. Regeneration of the marsh community occurs with lowered water levels that expose bottom sediments and re-initiate the cycle.

At the time of development, marsh areas consist of an evenly mixed stand of various plant species but continued flooding causes the formation of bands of vegetation reflecting various tolerances to water depths. In the Outlet

Lakes this characteristically produces a series in which Carex spp. inhabit the shallowest waters (zero to one foot), Scirpus spp. intermediate depths (one to five feet), and Potamogeton spp. deeper waters (five+ feet). Floating aquatics such as Lemna spp. may occur on the surface in various depths of non-flowing water.

4.4.3 Shorelines

Lakeshore and river banks in the Outlet Lakes region are used by wildlife in varying degrees. That use is a function of the shape and character of the substrate, vegetation, and habitat requirements of the wildlife species involved. The shoreline types classified by Newbury et al (1973) are shown in Table 1. Detailed descriptions of the eight types within the table, and two other less important types not included, are provided in Section 4.4.3.1. Wildlife relationships are outlined in Table 1.

Cross Lake has by far the largest extent of shoreline, followed by the East Channel, Upper Playgreen Lake, the West Channel, and Lower Playgreen Lake in that order. Similarly, Cross Lake has 240 miles of shoreline with obvious marshy features. The East Channel has approximately 104 miles of marsh edge, over 50 percent of its total shoreline. Other areas support miles of marshy edge varying from 3.5 (Kiskittogisu) to 34.8 (Little Playgreen Lake).

Over two-thirds of the steep bedrock and low bedrock shorelines are found on Cross Lake. Cross Lake also exceeds all other lakes and channels in terms of low bedrock controlled shoreline and bedrock controlled shoreline with overburden beach. The two parts of Playgreen Lake have almost 50 percent of the treed muskeg shoreline and over 50 percent of the floating fen type.

TABLE 1

PREDOMINANT WILDLIFE USE OF COMMON SHORELINE TYPES
OUTLET LAKES, MANITOBA

		APPROXIMATE MILES OF SHORELINE AND MARSH EDGE (m)									WILDLIFE USE	
SHORELINE TYPE	TYPICAL VEGETATION	Lower Playgreen	Upper Playgreen	Kiskittogisu	Kiskitto	Cross	West Channel	East Channel	Upper Nelson	Little Playgreen	Mammals	Birds
1. STEEP BEDROCK Photo 1	Outcrop: grasses, asters, rubus. Open deciduous: trembling aspen, willow. Open coniferous: Black spruce predominantly.		6			60	8	1	15	2	Mink: B, D, F.	Waterfowl: e.g. diving ducks. R. Passerines: e.g. warblers, sparrows, B,F,M.
2. LOW BEDROCK Photo 2	Outcrop: grasses, herbs. Open or closed Deciduous Forest Dominant species: trembling aspen birch. Scattered: black spruce, white spruce, balsam fir, willow, alder.	16 .6m	74 3.5m	23 1.5m	25	400 1.72m	86 2m	33 21m	17 6.5m	43 .6m	Bear: F.T. Lynx: F.T. Mink: F.T. Moose: F.T. Caribou: F.T.	Waterfowl: e.g. diving ducks. R. Shorebirds: e.g. spotted sandpiper B,F,M. Passerines: e.g. warblers, sparrows B,F,M. Marsh birds: e.g. grebes. B,F.
3. BEDROCK CONTROLLED WITH OVERBURDEN BEACH Photo 5	Closed deciduous scrub: balsam poplar, willow, sedge, grass. Closed coniferous or deciduous forest: Black spruce, white spruce trembling aspen, balsam poplar birch. Forbs: Labrador tea, sphagnum.	1	10 6m	5	2	90 83m	13 4m	41 23m	11 11m	9 5m	Mink: F.T. Lynx: F.T. Bear: F.T. Moose: F.T. Hares: B,F.	Waterfowl: e.g. lesser scaup and mallard. B,F,M. Shorebirds: e.g. minimal use by some species. Passerines: e.g. Traill's flycatcher, yellow warbler. B,F. Marsh birds: e.g. grebes, B,F.
4. LOW BEDROCK CONTROLLED Photo 4	Open or closed deciduous forest. Dominant species: trembling aspen, balsam poplar, some black spruce. Open or closed coniferous forest. Dominant species: black spruce some trembling aspen, birch.	1	7 1m	6	1	250 116m	24	42 12m	48 10m	4 .2m	Mink: F.T. Lynx: F.T. Bear: F.T. Moose: F.T. Hares: B,F. Beaver: F.	Waterfowl: e.g. lesser scaup and green winged teal. B,F. Shorebirds: e.g. spotted sandpiper, F,M. Passerines: (minimal use by some species) e.g. downy woodpecker, least flycatcher, red-eyed vireo, ovenbird, purple finch. B,F,M.
5. TREED MUSKEG Photo 6	Open water: pondweeds. Marsh: bulrush. Open coniferous forest: Dominant species: Black spruce. sedge. Treed Muskeg: Dominant species: Larch, birch, sedge.	43 3m	32 10m	25 1.5m	17	2 1m	12 2m	27 25m	2	21 8m	Black Bear: F.T. Caribou: F.T. Moose: F.T. Mink: F.T. Minimal Ermine: F. Minimal. Beaver: F. Minimal. Muskrat: Minimal. Lynx: Minimal. Fox, Wolf, Squirrel: Minimal.	Waterfowl: e.g. goldeneye, common merganser. B,F. Passerines: e.g. black-capped chickadee, palm warbler, B,F. Connecticut warbler, chipping sparrow, B,F, M. Raptors: e.g. Goshawk, owls. B,F.
6. LOW SHORELINE IN COARSE SEDIMENTS Photo 7	Marsh: Bulrush. Open or closed coniferous forest Dominant species: black spruce. Scattered: balsam poplar, trembling aspen, white spruce, alder on bank.	25 4.5m	12 6m	4 .5m		7 4.5m	6 1.5m	18 16.m	2 2m	1 1m	Black Bear: F. Caribou - summer only: F. Moose - summer only: F. Mink: F.T. Ermine: F.T. Otter: F. Beaver: Minimal. Muskrat: Minimal. Lynx: Minimal. Fox, Wolf: Minimal. Squirrel: Minimal.	Waterfowl: e.g. mallards, green-winged teal. F, R, M. Shorebirds: e.g. lesser yellowlegs spotted sandpiper. F, M. Passerines: e.g. hairy woodpecker, boreal chickadee, Nashville warbler. B, F, M. Raptors: e.g. Goshawk, owls. B, F.
7. LOW WILLOW SHORELINE Photos 8 & 9	Marsh: Bulrush, sedge, pondweeds, duckweed. Closed deciduous scrub: Dominant species: alder, willow, grasses. Open coniferous forest: Dominant species: Black spruce, Scattered: Birch, balsam fir.	24 9m	11 5m		4	35 35m	9 4.5m	9 7.5m		24 20m	Moose: F, R. Mink: F.T. Otter: Minimal. Beaver: F. Muskrat: B, F. - high use area.	Waterfowl: e.g. Canada goose mallard, pintail, B,F,R,M. Shorebirds: F,M. Passerines: e.g. Traill's flycatcher, yellow warbler, swamp sparrow. B,F,M. Raptors: e.g. marsh hawk, sharp-shinned hawk. F. Marsh birds: e.g. rails, common snipe. B,F.
8. FLOATING FEN Photo 10	Deciduous scrub: Dominant species: willow, sweet gale, horsetail. Floating fen: Dominant species: sedge, horsetail, sweet gale.	14	15	11	9	1					No mammal use.	Waterfowl: e.g. Canada goose, mallard. B,F,R. Shorebirds: e.g. common snipe. F,M. Passerines: e.g. Traill's flycatcher, yellow warbler, swamp sparrow. B,F,M. Marsh birds: e.g. common snipe, yellowthroat, red-winged blackbird. B,F. Raptors: e.g. eagle. F.

LEGEND

B = breeding
D = denning
F = feeding
M = migrating
R = resting staging
T = travelling

Cross Lake, Little Playgreen Lake, and Lower Playgreen Lake have most of the low willow shoreline. Cross Lake and Little Playgreen Lake have almost all the marshy edged shoreline of this type.

4.4.3.1 Shorelines in the Outlet Lakes

Steep Bedrock – A shoreline characterized by irregular, often steep, bare bedrock rising abruptly from the water surface. No emergent vegetation occurs in the deep waters adjacent to the shore. The foreshore is essentially barren with only a few hardy pioneer grasses and herbs present. Behind the bare foreshore a narrow zone of deciduous scrub occurs but is immediately replaced by the local upland vegetation; in most cases an open coniferous forest (Photo 1).

For the most part "bedrock and bedrock controlled" shorelines have little offshore emergent vegetation and as a result have little value as waterfowl habitat. Rocky barren foreshores provide little in the way of food plants or cover for wildlife species but foreshores characterized by scrubby deciduous stands or open deciduous forests provide browse for ungulates (eg. Cornus canadensis, Alnus spp. and Populus tremuloides) as well as broken cover for various bird species preferring forest edge habitats. Closed and open coniferous forests extending back from shoreline areas provide habitats for avian and mammalian species adapted to such areas but these are not primarily associated with shorelines.

Low Bedrock Shoreline – These shorelines are essentially similar to the foregoing type but do not have so steep a foreshore and generally have a wider zone of deciduous scrub behind the foreshore.

Bedrock - Controlled Shoreline with Overburden Beach - These shorelines do not have exposed bedrock foreshores and as a result a deciduous scrub zone encroaches upon the immediate shoreline area. This scrub zone while it approaches the water to a greater extent than in previous types is generally narrower and a closed coniferous or deciduous upland forest quickly replaces it as one moves away from the water. As with previous types the deep offshore waters preclude emergent vegetation.

Low Bedrock - Controlled Shoreline - A moderately sloped shoreline with bedrock overlain by shallow surficial deposits. A zone of open deciduous or coniferous forest characteristically closely encroaches upon the water's edge. Coniferous forest usually backs a deciduous shoreline band. Offshore emergent vegetation seldom occurs.

Shoreline in Coarse Sediments - This shoreline is not controlled by bedrock and is formed on deep glacial or lacustrine deposits. A relatively high moderately sloping bank is characteristic. Little emergent vegetation is present and a wide, usually barren, band of gravel beach is usually present. Sparse grasses, herbs or deciduous shrubs may occur over the beach area. Behind the foreshore a deciduous or mixed wood forest gives way to an open coniferous forest on the slopes.

Shoreline vegetation developing along shorelines underlain by alluvial lacustrine or glacial deposits because of the decreased relief and relatively richer substrate compared to bedrock situations tend to supply better habitat and cover for wildlife species. Offshore waters are often shallow and a suitable rooting substrate exists for the development of rich stands of emergent plants (Scirpus spp., Carex spp., Potamogeton spp., Lemna spp. and water tolerant grasses). These areas are attractive to waterfowl and muskrat,providing food, cover and nesting habitat. Foreshores display better development of deciduous scrub and forest bands probably as a result of improved climatic and soil conditions which supply browse for ungulates (Betula papyrifera, Cornus canadensis, Salix spp., Alnus crispa and various herbs). Vegetation on these foreshores is diverse in both form and composition and provides a variety of habitats for smaller avian and mammalian forms (particularly passerine birds).

Low Alluvial Shorelines - A gently sloping shoreline formed as a result of river deposition or alternately by deposition near tributary mouths. Offshore emergent vegetation is characteristic and consists of Carex spp. in very shallow water; often associated with willows growing at the beach-water interface. Behind the foreshore a relatively narrow band of deciduous scrub is immediately replaced by a closed coniferous forest.

Treed Muskeg Shoreline - A shoreline with low relief formed in poorly drained clay soils overlain by considerable organic material. Offshore emergent vegetation is often present and consists of Potamogeton spp. and Scirpus spp. A narrow bare beach occurs at the shoreline backed immediately by a low but steep bank. Along the top leading edge of the bank a narrow band of willows may occur but more often a open black spruce forest which extends back some several hundred feet from the shoreline. Drainage usually deteriorates away from channels and behind the black spruce shoreline band a treed muskeg area results with scattered larch, stunted black spruce, Salix spp. and various sedges and herbs.

Low Shoreline in Coarse Sediments - These shorelines are similar to and often associated with the previous type. They differ in that the backshore is consistently higher in profile and the clay sediments are overlain by coarse lacustrine deposits. An offshore zone of emergent Scirpus spp. grows in a wide belt (50-200 feet) or in large separate stands. An unvegetated sand beach, usually wider than that along treed muskeg shores, is backed by a low but steeply sloped bank at the top of which upland coniferous forest extends into the surrounding uplands.

Low Willowed Shoreline - Developing on relatively shallow (less than 10 feet) clay and silty clay deposits overlying bedrock. These shorelines are characterized by a low profile which often extends up to 500 feet back from the shore. Extensive offshore shallows are characterized by well developed marshes including an offshore band of Scirpus spp. and an inshore band of Carex spp. as well as a band of water tolerant grasses growing in the most shallow areas and on the immediate foreshore. Potamogeton spp. is often found throughout the marsh area. Behind the foreshore a broad band of closed deciduous scrub extends back to the first slopes of the adjoining uplands where shrub species such as Salix spp. and Alnus spp. give way to mixed birch and black spruce and finally to an open coniferous forest.

Fen Shoreline - The shores form an organic deposit underlain by unconsolidated materials. Relief is essentially lacking with shallow water extending some distance away from the shoreline and extensive flat meadow like fens making up the backshore. A narrow ridge rising less than two feet characterizes the immediate foreshore and this area is often shrubby with various willow species dominating. Fen vegetation behind the shoreline is dominated by sedges (Carex spp.), various bog herbs (Equisetum spp., Drosera intermedia) and stunted shrubs (Myrica gale). Because of the poor nutrient status of such areas, the lack of real soils and the excess moisture present,production and hence the carrying capacity of fen areas for wildlife is limited.

Photo 1 Steep bedrock shoreline. Mink utilize this shoreline type for denning and foraging.

Photo 2 Low bedrock shoreline. This shoreline type is common on Hoss Lake.

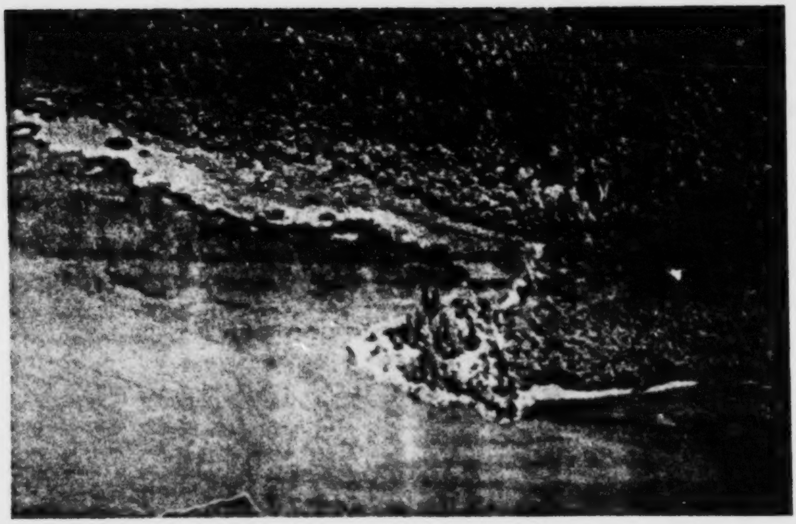


Photo 3 Low bedrock shoreline showing marsh development. Typical zonation of aquatic and emergent plants is illustrated. Furthest offshore are submerged pondweeds (Potamogeton), next a dark band of bullrushes (Scirpus) and closest to shore, a light coloured stand of sedges (Carex).

Photo 4 Low bedrock - controlled shoreline. Deciduous and mixedwood cover usually occur on these shorelines.

Photo 5 Bedrock - controlled shoreline with overburden beach. This shoreline type is common along the Nelson River.

Photo 6 Treed muskeg shoreline. Marshes, dominated by bullrushes and sedges, often develop in bands along this shoreline type.

Photo 7 Low shoreline in coarse sediments. Sand beaches are common with off-shore stands of bullrushes providing marsh habitat.

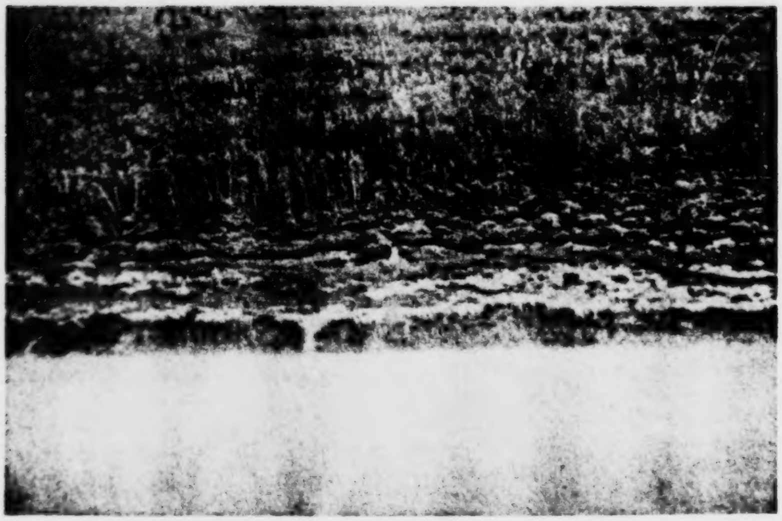


Photo 8 Low willowed shoreline on Nelson River. Shorelines of this type occur in areas of low relief such as shallow bays. Willow-deciduous area provides good moose habitat.

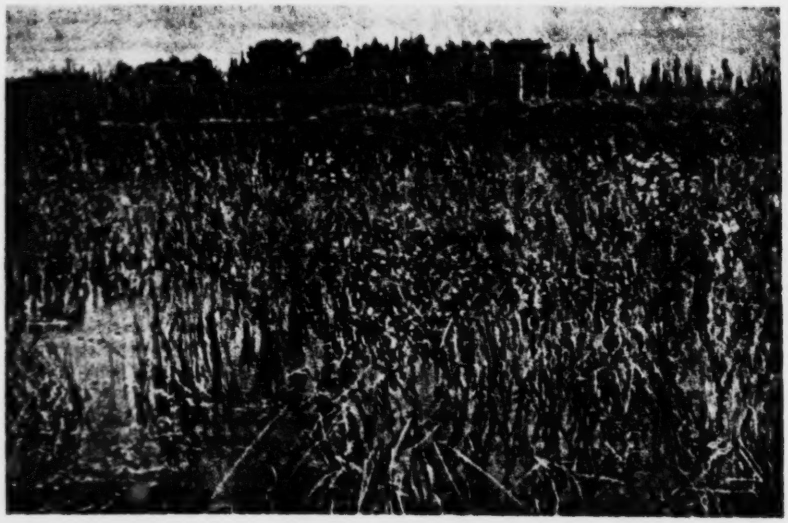


Photo 9 Low willowed shoreline on Cross Lake. The offshore emergent and aquatic vegetation occuring above these shorelines attracts waterfowl during migration periods and may furnish significant breeding habitat.

Photo 10 Floating fen shorelines. This shoreline type occurs in areas with little relief and is found only on Kiskitto, Kiskittogisu and South Playgreen Lakes.

Photo 11 Waterfowl staging areas near Kiskittogisu Lake. This area is rated as a potentially important staging area for waterfowl by the Canada Land Inventory System.

Photo 12 Cross Lake marshes. These areas are used as a fall staging area for Canada geese and several species of duck.

Photo 13 8-Mile Channel dredging. The construction of this by-pass channel will affect waterfowl and ungulate habitats.

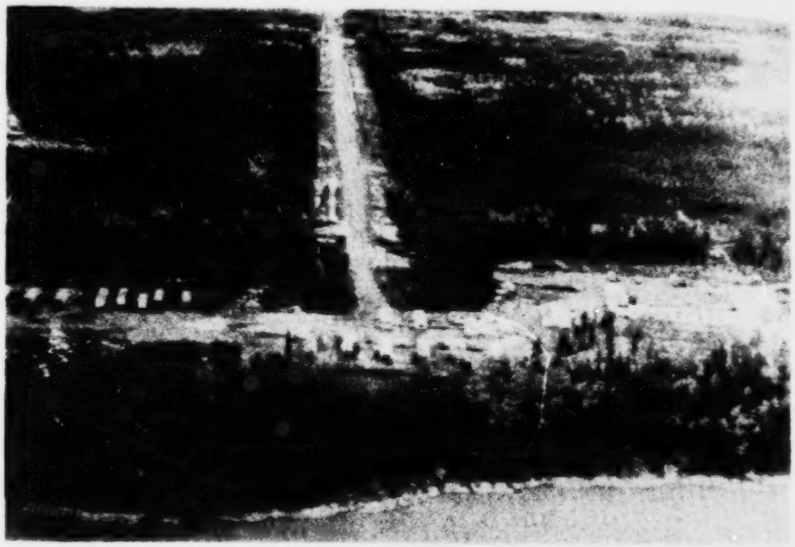


Photo 14 8-Mile Channel construction camp. Harassment of wildlife populations may occur near centers of construction activity

Photo 15 Jenpeg airstrip and service roads. New transportation facilities will be available following construction. These will increase accessibility and affect the harvest of game animals.

PART 5

METHODOLOGY

5.1 METHOD OF OPERATION

To fulfill the several objectives of the work, a program of liaison, study and recommendation was undertaken. This report deals essentially with study and recommendation aspects and includes new material plus the substance of previously submitted reports on the East Channel, Kiskitto Lake and eight mile channel issues.

Written reports on those three matters were submitted November 7, and December 8 and 11, 1972. Follow-up verbal reports were given at several Winnipeg meetings held in January and February, 1973.

The wildlife liaison function was primarily carried out by attendance at various formal and informal meetings hosted in Winnipeg by the Study Directorate, exchange of data with other study contractors through direct contact and letters, and irregular meetings with research, planning and operational personnel of DMREM, the Canadian Wildlife Service, and Ducks Unlimited.

5.2 DATA GATHERING

Data pertinent to the study were obtained by various means. Field reconnaissance surveys were undertaken. Air photographs, maps and other information were made available by the Study Directorate. Reports, letters and memoranda were obtained from provincial and federal government agencies. Interviews were conducted with provincial and federal government personnel and private individuals and agencies. Study Board contractors provided supplementary data as they became available. Published literature sources were reviewed.

The hydroelectric project was reviewed. Engineering specifications for various control structures, dykes, roads, etc. and predicted water level changes as provided by Manitoba Hydro were assessed in order to fully understand potential effects on wildlife and wildlife habitat.

Available data were obtained from the provincial Department of Mines, Resources and Environmental Management. These data included reports, memoranda and letters pertaining to the results of wildlife work carried out within the Outlet Lakes region and elsewhere in the north. In addition, various DMREM employees were interviewed and provided valuable information.

DMREM provided reports on caribou, moose, birds and furbearers as well as fur harvest statistics from fur dealer returns, waterfowl statistics, and hunter questionnaire data. Observations relating to ungulates were provided via interviews with the following government field personnel: D. Allen, W. Pollard, R. Schlick, T. Paddock. Other government personnel based in Winnipeg also provided pertinent information.

Waterfowl information was received from the Canadian Wildlife Service and ungulate information from the University of Manitoba. The Canada Land Inventory Project provided capability data for ungulates and waterfowl and the Fund for Rural Economic Development provided waterfowl reports.

Meetings were attended and directives, information and data from the Study Directorate were incorporated into the wildlife study program.

Data provided by other study groups contracted by the Study Board were utilized throughout the wildlife study. Some of the reports received include: fall progress reports, Shoreline Classification, Dredge Spoil Study, Regulation of Kiskitto Lake, and Program for Regulation of Lake Winnipeg. Discussions were held with contract groups representing recreation, socio-economics, fisheries, soils and vegetation, transportation, shoreline impact, and water level and flow data.

5.3 SURVEY METHODS

Aerial flights were made over the Study Area. Reconnaissance flights were made in order to obtain an overview of the hydro development project. In 1972, wildlife surveys were conducted in specific sample areas. A moose aerial transect survey was conducted in late November. The transect lines and flight data are presented in Appendices 2 and 5 respectively. Waterfowl surveys were conducted in late September. Flight lines and data are shown in Appendix 4.

5.4 REPORT DEVELOPMENT

Using data gathered by the various techniques and procedures outlined above, the following system of analysis and interpretation was employed to reach the conclusions discussed in succeeding sections of this report.

Wherever possible wildlife observations were related to shoreline types as provided by Newbury et al (1973). Their reference to marsh vegetation was useful in determining relative values of shoreline habitats for certain furbearers and many groups of birds, particularly waterfowl.

Some agreement between moose distribution and shoreline types was evident. However, more meaningfull relationships were found between moose and Canada Land Inventory (CLI) capability data. Woodland caribou distribution was related to CLI capability data.

Estimates of licensed hunter harvests for the larger management areas, Game Hunting Area 3 for ungulates, and Game Bird Management Unit 1 for waterfowl, were related to harvest or "kill" estimates derived for the Outlet Lakes region from various sources. This method allowed comparison of wildlife utilization patterns in the Study Area with larger, and more meaningful Manitoba units.

It was necessary to interpret and refine the Manitoba Hydro engineering data that was provided in order to produce an understanding of the primary physical effects expected from implementation of Hydro proposals. Those physical effects were considered in terms of wildlife habitat values.

Major wildlife involvements were deduced, and listed and evaluated in relation to the primary physical effects of development.

For each of the main wildlife involvements one or more possible mitigation procedures were outlined and discussed.

Finally, those key issues and the related mitigation requirements which were considered most important, were isolated and presented as recommendations.

PART 6

OBSERVATIONS AND CONCLUSIONS

6.1 THE WILDLIFE RESOURCE

6.1.1 Ungulates

Ungulate species present within the Study Area include whitetail deer, moose, woodland caribou and barren ground caribou. Whitetail deer and barren ground caribou are at the northern and southern extremities of their respective ranges and occur infrequently or in low numbers. The two most abundant species, and therefore most important for the purposes of this study, are moose and woodland caribou. Both have distinctive habitat requirements but are often found in the same forest type. They are utilized as food by native people and are hunted in a limited way by non-local hunters.

6.1.1.1 Moose

Habitat

Very dry and very wet sites within the Outlet Lakes support jack pine or muskeg and thus provide moderate to poor moose habitat. Both types tend to perpetuate themselves - the former after fire and the latter because of acidic conditions. Conversely, fresh to moist sites on clays or glaciofluvial sands generally support mixedwood stands that are replaced by other, similar mixes after fire. Climax is a black spruce-feathermoss community. Seral stages within this type provide moderate to good moose habitat. Near shorelines, the influence of a favourable microclimate can produce more diverse mixtures of trees, shrubs and herbs, and thus excellent moose habitat. (Photo 8).

The shoreline types which provide best moose habitat are the low bedrock controlled, low willowed and low bedrock. Low alluvial and bedrock controlled with overburdened beach provide narrow bands of browse species.

Cross Lake, West Channel and Upper Playgreen Lake support greatest amounts of shoreline of importance to moose. Cross Lake has over 650 miles of favourable shoreline, as much as all other areas together.

Moose habitat potential has been determined by the Canada Land Inventory system over most of the Study Area (Appendix 1). In general, capability ratings agree with assessments of current habitat value based on shoreline and vegetative communities. Class 2 habitat has the greatest potential for moose production in the Outlet Lakes area and occurs primarily along rivers and lake shorelines. Most important areas are Cross Lake, West Channel and Upper Playgreen Lake. Class 3 and 4 areas with moderate to severe limitations on potential moose production occur irregularly throughout the region.

Capability ratings indicate the following potential habitat for moose in the West Channel or Jenpeg forebay:

Class 2	-	26.3 square miles
Class 3	-	5.1 square miles
Class 4	-	6.0 square miles

The absence of floodline information prohibits similar calculations elsewhere.

Density and Distribution

No previous moose population data were available for the Study Area. An aerial transect survey was conducted in November 1972 (Appendices 2 and 5) and the results compared with provincial survey results from areas closest to the Outlet Lakes (Table 2).

TABLE 2

MOOSE DENSITIES IN NORTHERN MANITOBA

(Moose per square mile - unadjusted transect survey data)

	YEAR												
Area	'61	'62	'63	'64	'65	'66	'67	'68	'69	'70	'71	'72	Data Source
Lynn Lake	.45	.49	.49	.43	.14	.18	.18	.18					DMREM
Thompson							.24	.18					DMREM
Granville Lake-Rat River									.2				Underwood McLellan (1970)
Outlet Lakes												.3	F.F. Slaney (1972)

The average for other surveys was 0.29 moose per square mile and the Outlet Lakes survey 0.3 per square mile. Survey methods were comparable and therefore it is assumed that moose densities are in the same general range. The 0.3 moose per square mile result is a minimal figure reflecting only those animals seen on transect. Actual densities may be two or three times as large. No moose were sighted in large, closed coniferous stands and visibility during the survey was considered to be only poor to fair.

All moose sighted were adjacent to stands of conifers and near or in deciduous scrub, comprised mostly of aspen, birch, alder and willow. About 50 percent of the animals sighted were within 200 yards of a lake, river or stream shoreline. Other moose sighted, with the exception of two or three animals, were near the edges of bogs or fens.

The observations were made during late fall and it is assumed the animals were on winter range. Snow cover was about 11 inches in depth and temperatures 0 to -10°F.

Based on CLIP density ranges for capability classes, the following potential numbers of moose are possible within the Jenpeg forebay (Goulden, pers. comm.).

Class	Density Range	No. of Moose
2	1.1-1.5 per square mile	29 - 39
3	0.7-1.0 per square mile	4 - 5
4	0.4-0.6 per square mile	2 - 4
	TOTAL	35 - 48

Human Utilization

The Outlet Lakes are within provincial Game Hunting Area 3, an area bounded by the Ontario border, Gillam and Grand Rapids. GHA 3 contains approximately 40,000 square miles and the Outlet Lakes area about 6000 square miles of land area. Table 3 includes estimates of moose harvests for the years 1965-1971 inclusive for both GHA 3 and the Outlet Lakes area, based on hunter questionnaires and Conservation Officer estimates.

A broad comparison can be made of harvest rates in the 2 areas (Table 4).

TABLE 3

MOOSE HARVEST STATISTICS FOR LICENSED HUNTERS 1965-1972
OUTLET LAKES AND TOTAL GHA 3

	HARVEST				
	Game Hunting Area 3		Outlet Lakes Area		
Year	Reported+	Estimated+	Reported+	Estimated+	Estimated*
1965-66	1	104			
1966-67	10	100			5
1967-68	16	130			2
1968-69	--	82			4
1969-70	5	55	2	20	2
1970-71	6	62 (±47)	2	20	2
1971-72	7	80	1	10	2
Average		88		17	

+ DMREM hunter questionnaire (10 percent sample).

* Conservation Officer estimate for Cross Lake and Norway House area.

TABLE 4

LICENSED HUNTER MOOSE HARVESTS
OUTLET LAKES AND TOTAL GHA 3

	GHA 3	Outlet Lakes
Square miles of land area (approx.)	40,000	6,000
Moose survey index	0.29	.3
Estimated population index	*26,000	*4,000
Allowable harvest (20% Howard 1968)	5,200/year	800/year
Estimated harvest	+ 88/year	+ 17/year
Percent of allowable harvest	< 1	> 2

* Times estimated visibility factor of 2

+ Does not include harvest by native people

The data suggest that recreational moose hunting pressure is extremely light in both areas and that the Outlet Lakes sustains a slightly greater than average share. Although only about 13 percent of the total area of GHA 3, the Outlet Lakes harvest comprises about 20 percent of its total licensed hunter kill.

Moose are hunted by native persons as a source of food in a generally unrestricted manner. They take moose as needed or when readily available, mainly along trails, waterways and roads. Most animals are taken during the fall and winter when access is easier and animals are in good condition. No reasonable estimate of this harvest can be made but is probably greater than that taken by licensed hunters.

6.1.1.2 Woodland Caribou

Habitat

Good quality habitat areas for caribou feature mature spruce and jack pine stands interspersed with upland bogs (Carbyn, 1960). These areas contain a suitable mix of cover and food for critical winter periods. Food preferences include arboreal and ground lichens, various shrubs and sedges. Burned over areas usually do not support caribou populations in winter (Carbyn, 1968).

The well-drained, south-eastern part of the Outlet Lakes area with its extensive coniferous forest cover comprises good caribou habitat (Appendix 1). Shoreline areas are generally not critical to caribou in winter.

Traditional calving grounds of caribou are critical habitat areas important to the welfare of the populations using them. Preferred sites are islands of an acre or more in size supporting a mature mixed wood forest (Miller, 1968). Islands in Kiskittc, Kiskittogisu and Playgreen Lakes are apparently used for calving from early spring (April) to early summer (late June). Parturition occurs in late May and early June.

The Canada Land Inventory system rates the Outlet Lakes area as Class 2, 3, and 4 for woodland caribou. The distribution of Class 2 areas is shown in Appendix 1. In addition, it is likely that some Class 2 area is presently adjacent to the northeast portion of Cross Lake, not mapped to date.

The total area of the various capability classes present in the Jenpeg forebay area are:

Class 2 - unknown quantity
Class 3 - 1.2 square miles.
Class 4 - 3.4 square miles.

Numbers and Distribution

An estimated 5,000 woodland caribou exist in Manitoba. Densities in the Outlet Lakes region are rated as light (DMREM, 1961). Several caribou surveys have been flown over the Study Area (Pelechaty, 1972; Miller, 1968; Howard, 1960; Guymer, 1957 and 1958). Due to inherent difficulties in survey techniques no firm population estimates are provided in the various reports. Several authors attempted to distinguish the geographical distribution of caribou herds in northern Manitoba (Miller, 1968; Guymer, 1957 and 1958). Norway House and Cross Lake herds apparently occur within the Outlet Lakes region.

The most important seasonal use areas for the Norway House herd are presented in Map 3. Winter use is associated with bog and climax forest types where found in large tracts, and spring use with island calving areas. Two possible migration routes are also indicated.

Although no data are available on the Cross Lake herd, it is possible that various islands in Cross Lake may be utilized for calving. Migration routes would be located between the calving and wintering areas.

Human Utilization

Caribou are utilized as both a source of food by native people and for recreation by licensed hunters. The annual harvest by Treaty Indians is approximately 20 animals per year within the Norway House area (D. Allen, pers. comm.). No estimates are available for Cross Lake.

Native people usually hunt caribou within a 20 mile radius of Norway House. Hunting is opportunistic, in that if a migrating herd is sighted within a reasonable distance of the settlement, animals will be taken. Native people do not go hunting caribou each year at a specific time.

Caribou harvests by licensed hunters for 1969 - 71 are presented in Table 5.

TABLE 5

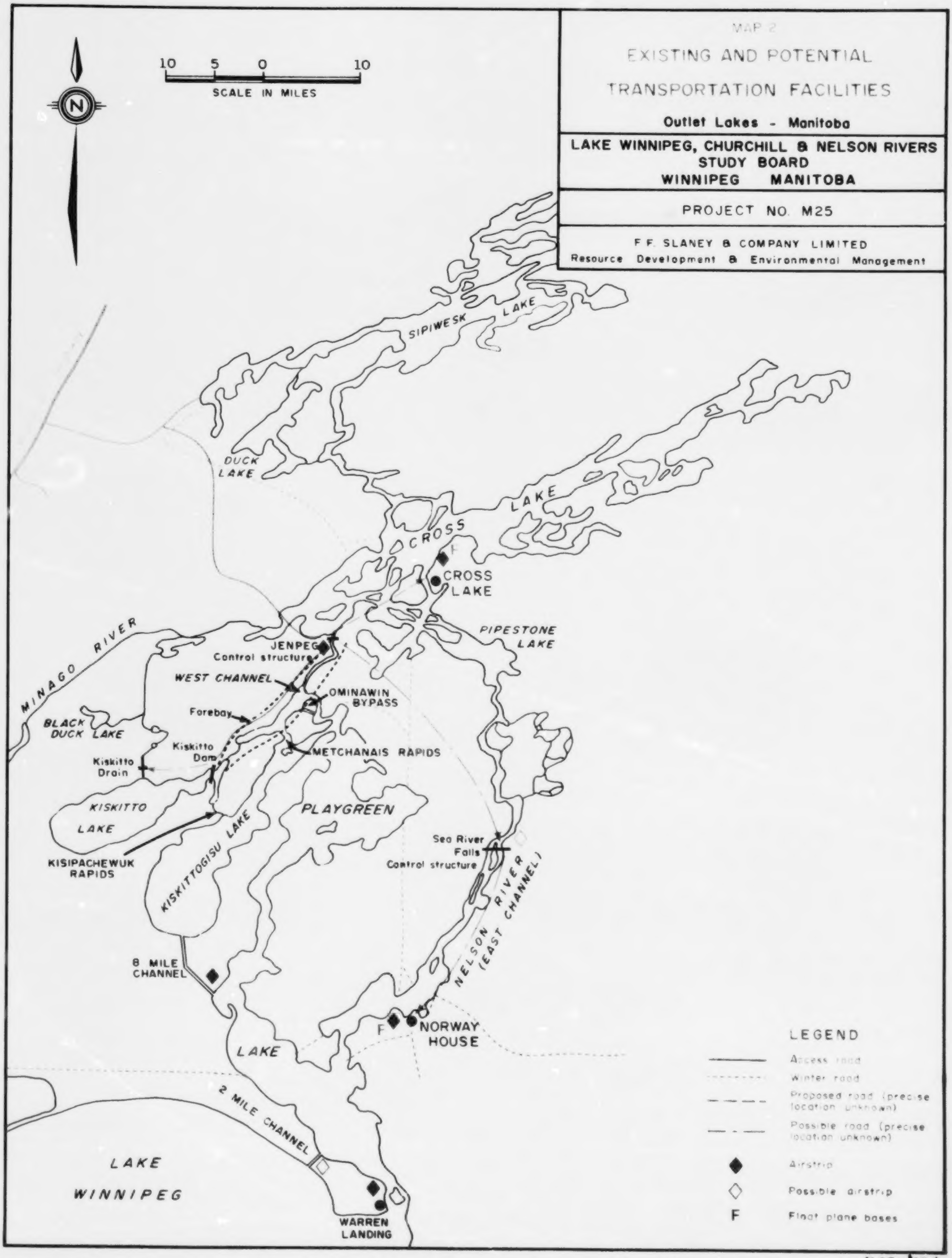
CARIBOU HARVESTS FOR GAME HUNTING AREA 3 AND OUTLET LAKES

(based on DMREM hunter questionnaire returns)

Year	Total Estimated Kill for Area 3	# Licensed Hunters for Area 3	Outlet Lakes Kill No.	Outlet Lakes Kill % of Total GHA 3
1969	1	--	1	100%
1970	19 ± 3	22	13	68%
1971	19 ± 3	15	11	73%

The data indicate that two-thirds or more of the total caribou harvest for GHA 3 occurs within the Outlet Lakes area. The locations of resident licensed hunter kills are included in Appendix 2. The winter use area shown on Map 3 is the most important area for recreational hunting.

The proposed transportation network of winter roads is shown on Map 2. A comparison of winter road kill locations and settlement kill locations suggests that caribou are harvested along winter roads centered by Norway House.



MAP 2

EXISTING AND POTENTIAL TRANSPORTATION FACILITIES

Outlet Lakes - Manitoba

LAKE WINNIPEG, CHURCHILL & NELSON RIVERS STUDY BOARD
WINNIPEG MANITOBA

PROJECT NO. M25

F.F. SLANEY & COMPANY LIMITED
Resource Development & Environmental Management

N
10 5 0 10
SCALE IN MILES
SIPIWESK LAKE
DUCK LAKE
CROSS LAKE
CROSS LAKE
F
PIPESTONE LAKE
MINAGO RIVER
JENPEG
Control structure
WEST CHANNEL
OMINAWIN BYPASS
Forebay
BLACK DUCK LAKE
Kiskitto Dam
Kiskitto Drain
METCHANAIS RAPIDS
KISKITTO LAKE
PLAYGREEN
KISKITTOGISU LAKE
KISIPACHEWUK RAPIDS
Sea River Falls Control structure
NELSON RIVER (EAST CHANNEL)
8 MILE CHANNEL
LAKE
F
NORWAY HOUSE
2 MILE CHANNEL
LAKE WINNIPEG
WARREN LANDING
LEGEND
Access road
Winter road
Proposed road (precise location unknown)
Possible road (precise location unknown)
Airstrip
Possible airstrip
Float plane bases

M 25 M2.0

MAP 3

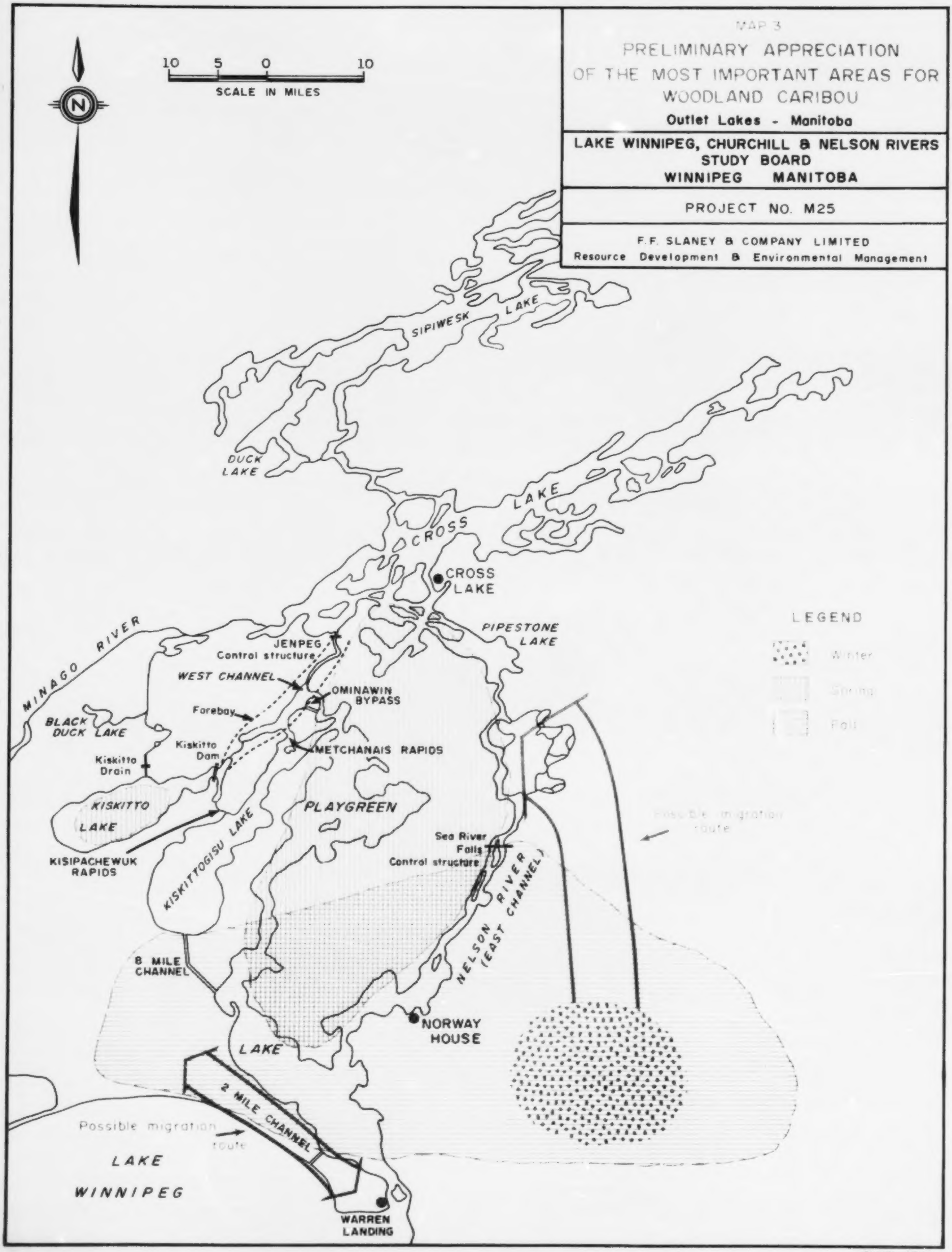
PRELIMINARY APPRECIATION OF THE MOST IMPORTANT AREAS FOR WOODLAND CARIBOU

Outlet Lakes - Manitoba

LAKE WINNIPEG, CHURCHILL & NELSON RIVERS STUDY BOARD
WINNIPEG MANITOBA

PROJECT NO. M25

F.F. SLANEY & COMPANY LIMITED
Resource Development & Environmental Management



10 5 0 10
SCALE IN MILES
N
SIPIWESK LAKE
DUCK LAKE
CROSS LAKE
CROSS LAKE
PIPESTONE LAKE
MINAGO RIVER
JENPEG Control structure
WEST CHANNEL
OMINAWIN BYPASS
Forebay
BLACK DUCK LAKE
Kiskitto Dam
Kiskitto Drain
METCHANAIS RAPIDS
KISKITTO LAKE
KISIPACHEWUK RAPIDS
KISKITTOGISU LAKE
PLAYGREEN LAKE
Sea River Falls Control structure
NELSON RIVER (EAST CHANNEL)
8 MILE CHANNEL
NORWAY HOUSE
2 MILE CHANNEL
Possible migration route
Possible migration route
LAKE WINNIPEG
WARREN LANDING
LEGEND
Winter
Spring
Fall

M 25 - M2.'c

6.1.2 Furbearers

Furbearers apparently provide an important part of the economic base of Norway House and Cross Lake in that 400 trappers, representing almost as many families, hold and operate traplines. Beaver and mink provide the bulk of the trapper returns, followed by muskrat and lynx. Several other species including red squirrel and ermine are also trapped, but form only a small part of the total trapping return.

6.1.2.1 Distribution and Habitat Relationships

Muskrats

Rooted aquatic vegetation is required by muskrats for both food and house building. In marshy habitat houses are built but in some areas bank burrows are utilized. Water depth must be such that freezeout does not occur during the winter months.

The most important marsh plant species found in good muskrat habitat of northern Manitoba are as follows (MacLeod, et al, 1951):

Scirpus acutus -	Big Bulrush
Scirpus validus -	Great Bulrush
Scirpus fluviatilis -	River Bulrush
Typha latifolia -	Broad-leaved Cattail
Typha angustifolia -	Narrow-leaved Cattail
Equisetum limosum -	Scouring Rush
Phragmites maximus -	Flagreed
Potamogeton spp. -	Pondweed
Myriophyllum spp. -	Water Milfoil

Ceratophyllum demersum -	Coontail
Sparganium eurycarpum -	Bur Reed
Acorus calamus -	Sweet Flag
Carex spp. -	Sedge

Primarily because of accessibility under the ice, the most important species during the winter period are *Equisetum*, *Scirpus* and *Potamogeton*. Those important during the summer period are *Equisetum*, *Scirpus* and *Phragmites*. General species occurrence with regard to water depth is as follows·

0 feet	*Carex*
0 - 1 foot	*Phragmites maximus*
1 - 3 feet	*Typha* and *Scirpus fluviatilis*
3 - 5 feet	*Scirpus*
5 + feet	*Potamogeton*

Equisetum, *Scirpus*, and *Potamogeton* are present within the marsh areas of the Outlet Lakes in varying amounts (Newbury, 1973).

The most important areas for muskrats in terms of habitat quality and miles of shoreline are Lower Playgreen, Cross, and Little Playgreen Lakes in descending order.

The water regime is important to muskrat production and welfare. Fluctuating water levels within certain limits can be beneficial if they promote emergent plant growth and reproduction. Greatly increased water levels, or fluctuations at unusual times of the year may kill vegetation and cause marsh areas to revert to an open water situation. Reduced levels in winter may result in direct mortality if low enough to allow freezing to the bottom. Winter levels in excess of four feet are probably required so as to prevent freeze-out.

Beaver

Beaver habitat is mainly on smaller creeks and channels but some lodges were observed on lakeshores. Beaver populations are usually associated with aspen, alder or birch adjacent to shorelines.

The most important areas for beaver in terms of shoreline are Cross Lake, the East Channel and the Upper Nelson River.

Mink

The prime prey species of mink is the muskrat. Other prey include small rodents, shellfish, insects, birds and fish. Food habits change on a seasonal basis and basically involve the use of aquatic species during the summer period and muskrats during the winter period (Urban, 1969).

The most important areas within the Outlet Lakes in terms of shoreline habitat for mink are Cross Lake, West Channel, Upper Playgreen Lake and the East Channel, in descending order.

Lynx

Lynx are found throughout the Outlet Lakes area. The north central portion of Manitoba contains the most dense population of lynx within the province (DMREM, 1961) and the Outlet Lakes region lies within this zone. The lynx requires large land areas for its existence and roams throughout all forest types including shorelines. Its major prey species is the varying hare, and therefore deciduous vegetation important to hares is also important to lynx.

Other Furbearers

Other furbearers are present within the Outlet Lakes area. These include the weasels, foxes, red squirrel, marten, wolverine, and wolf. Most require a land base but are also associated to some degree with water-land ecotones. Their requirements are important from an ecological point of view but they contribute little towards fur production within the Outlet Lakes area.

6.1.2.2 Fur Production

Furbearers in northern Manitoba are harvested under a Registered Trapline (RTL) system. Large areas or sections are subdivided into individual traplines. Most traplines are assigned to an individual who often retains helpers during the trapping season. In areas adjacent to settlements, large community blocks are set up for use by trappers from the settlement who do not have their own lines. Recently, trapper organizations have been formed in order to facilitate better furbearer harvests and increase liaison with various government departments.

Portions of both the Norway House and Cross Lake Registered Trapline sections occur in the Outlet Lakes (Appendix 3). The community line for Norway House is No. 1 and for Cross Lake No. 56. The Norway House line averages 80-85 trappers per year while the Cross Lake line averages about 50 trappers per year. All other lines are registered to one person who may or may not utilize helpers. Individual lines average a total of 2.3 trappers per year. An approximate total of 400 trappers are therefore accommodated.

Species trapped within the Outlet Lakes area include the fox, wolf, beaver, muskrat, ermine, mink, otter, squirrel, lynx, and fisher. Due to the time differential in pelt priming of various species, trapping for individual species is usually restricted to certain periods of the year, eg. muskrats - spring and fall; mink - early winter; lynx - mid-winter. The trapping season begins in October-November and continues through until May.

Animals are pelted both on the trapline and at the trapper's home. All subsequent pelt preparation after skinning (stretching, scraping, drying, turning, etc.) is usually done by the trapper at home. Pelts are usually sold through local fur dealers.

Fur production data for the four most important furbearers are presented in Table 6 and Appendices 6 - 15. From a dollar standpoint, the five year data indicate that beaver are the most productive species, followed by mink, muskrat, and lynx. They constitute about 90 percent of the economic return in each of the years shown.

It should be noted that the dollar return both by species and in total annually fluctuates to a large degree. Fluctuations are related to factors not always associated with animal populations (Slaney & Company, 1972).

6.1.2.3 Potential Fur Production

Fur production is basically controlled by world market value and therefore fluctuates annually. Current sale prices are much higher than at any time during the period for which data are presented and therefore economic returns from the 1972-73 season are expected to increase. Furthermore, it is the apparent policy of the provincial government to encourage

TABLE 6

OUTLET LAKES FUR RETURN FROM MAJOR SPECIES ($) 1966-67 TO 1970-71

(from DMREM fur dealer returns)

R.T.L. Section	Year	Beaver	Muskrat	Mink	Lynx	Total
Cross Lake	1966-67	4,938.00	6,945.40	12,699.00	120.00	24,702.40
	1967-68	6,876.00	2,487.00	4,026.00	66.00	13,455.00
	1968-69	28,882.00	5,599.95	38,581.00	4,756.00	77,818.95
	1969-70	20,862.00	3,640.15	12,044.00	13,560.00	50,106.15
	1970-71	9,653.00	7,870.40	897.00	5,317.00	23,737.40
Norway House	1966-67	4,554.00	8,803.30	6,086.00	216.00	19,659.30
	1967-68	14,562.00	10,901.00	9,760.00	264.00	35,487.00
	1968-69	30,536.00	6,088.40	28,901.00	2,787.00	68,312.40
	1969-70	17,499.00	4,533.90	13,286.00	9,420.00	44,738.90
	1970-71	12,230.00	7,375.85	3,080.00	8,031.00	30,716.85

production so as to provide a more reliable investment return. A federal-provincial fur agreement is presently in existence for this purpose and solutions to various problems are being sought through this vehicle. The provincial government is expanding its role in fur management. Research has been conducted on furbearer populations and management (vanZyll de Jong, 1970). Socio-economic studies (DMREM, 1971) have assessed the feelings and needs of trappers. The Development and Extension Service Branch has full time employees aiding in the organization and education of trappers. This thrust of fur production development should increase both production and quality of furs. The majority of furbearer species are generally underharvested, although it is not clear that this is the case in the Outlet Lakes. Nevertheless, the initiation of long term management and organizational programs will encourage harvest of furbearer species at a higher level.

6.1.3 Birds

The avifauna of the Study Area is characterized by species commonly associated with both the Canadian Shield and the Manitoba Lowlands. A tentative checklist of breeding birds has been drawn up and is presented in Appendix 16. Sources for this list were Godfrey (1966), Vermeer (1970a, 1970b, 1970c), Hanson (1965) and Walkinshaw (1965), interviews with local Conservation Officers and field observations by F.F. Slaney & Company personnel.

A number of species occurring in the area can be tentatively assigned high economic or aesthetic values or are regarded as being rare and/or endangered. Economically valuable species include most waterfowl while those of particular aesthetic interest include the colonial fish eating species and certain birds of prey. Species considered endangered in Manitoba include the white pelican, double-crested cormorant, bald eagle and osprey, while the greater sandhill crane is considered rare (vanZyll de Jong and Nero, 1971).

6.1.3.1 Waterfowl Numbers and Distribution

Whistling Swan

No breeding birds occur in the Outlet Lakes area although migrants from arctic regions were observed during the fall period. Fall migrants were most numerous along the east shore of Kiskittogisu Lake and the west shore of lower Playgreen and occurred sporadically elsewhere (Appendix 4). Numbers were low.

Canada Goose

This is the only breeding goose species reported for the area. While they occur regularly, their numbers have not been reported as large. Several active nests were observed on small islands in Kiskitto Lake during June, 1972.

Small flocks of large geese are reported in the fall. F.F. Slaney & Company observations are in Appendix 4. Many small groups were observed, with the most significant areas being Cross and Duck Lakes, with 1100 and 400 respectively.

Their taxonomic status is unknown. The Hudson Bay coastal plain, the Churchill River downstream from Northern Indian Lake and the Cumberland area near The Pas have been reported to support substantial breeding populations of "possibly" three different races. The so called "giant Canada" (Branta canadensis maxima) is a prairie nesting goose not known to extend their nesting range beyond the marshes of The Pas. Those along the Hudson Bay lowlands are assigned to the subspecies B. c. interior, being of intermediate size. The Churchill River population only recently studied has been tentatively assigned to a third race (Hanson, 1965).

Although "giant Canada" have been reported from Playgreen Lake (pers. comm. D. Allen) it seems likely most breeding geese in the area would belong to the race B. c. interior or to the suggested new race represented in the Churchill River population. In the Study Area B. c. maxima could be beyond the limit of the habitat in which it presumably evolved and to which it adapted (Hanson, 1965). However, subadults of this subspecies are known to make summer moult migrations deep into the subarctic to areas west and north of Hudson Bay; they were in fact described by Samuel Hearne in 1795 (Hanson, 1965). Observations of giant Canada in the Outlet Lakes could be of birds undertaking such flights.

Dabbling Ducks

Common pond ducks of the Study Area include the mallard, gadwall, pintail, green-winged teal, American widgeon, and shoveler. They are apparently not numerous in the Outlet Lakes area during the breeding season although substantial concentrations were observed during fall migration September 24-26, 1972 (Appendix 4). Mallards are the most commonly reported species during summer. These species are birds of ponds and are not common summer residents on large bodies of water unless in niches well protected by marsh vegetation.

The Boreal Forest is not considered prime breeding habitat. Its value arises from vastness and its role as a buffer of permanent water against prairie droughts. Table 7a compares average breeding pair densities obtained throughout western Canada from 1960 - 1969 inclusive. (Vermeer, 1972).

TABLE 7a

BREEDING PAIR DENSITIES

(Pairs/square mile)

Species	Aspen Parklands and Grasslands	Boreal Forest
Mallard	3.8	0.6
Gadwall	0.6	0.0
Pintail	1.9	0.1
Green-winged Teal	0.2	0.1
Blue-winged Teal	0.6	0.1
American Widgeon	0.7	0.2
Shoveler	0.9	0.1
Redhead	0.2	0.0
Canvasback	0.4	0.1
Lesser Scaup	0.9	1.4

Canada Land Inventory provisional maps of the Study Area (Wekusko, Cross Lake Grand Rapids and Norway House sheets) rate 87 square miles adjoining Kiskitto, Kiskittogisu and Playgreen Lakes as being potentially good waterfowl migratory habitat. No areas were rated as being important production areas. (Appendix 4).

Diving Ducks

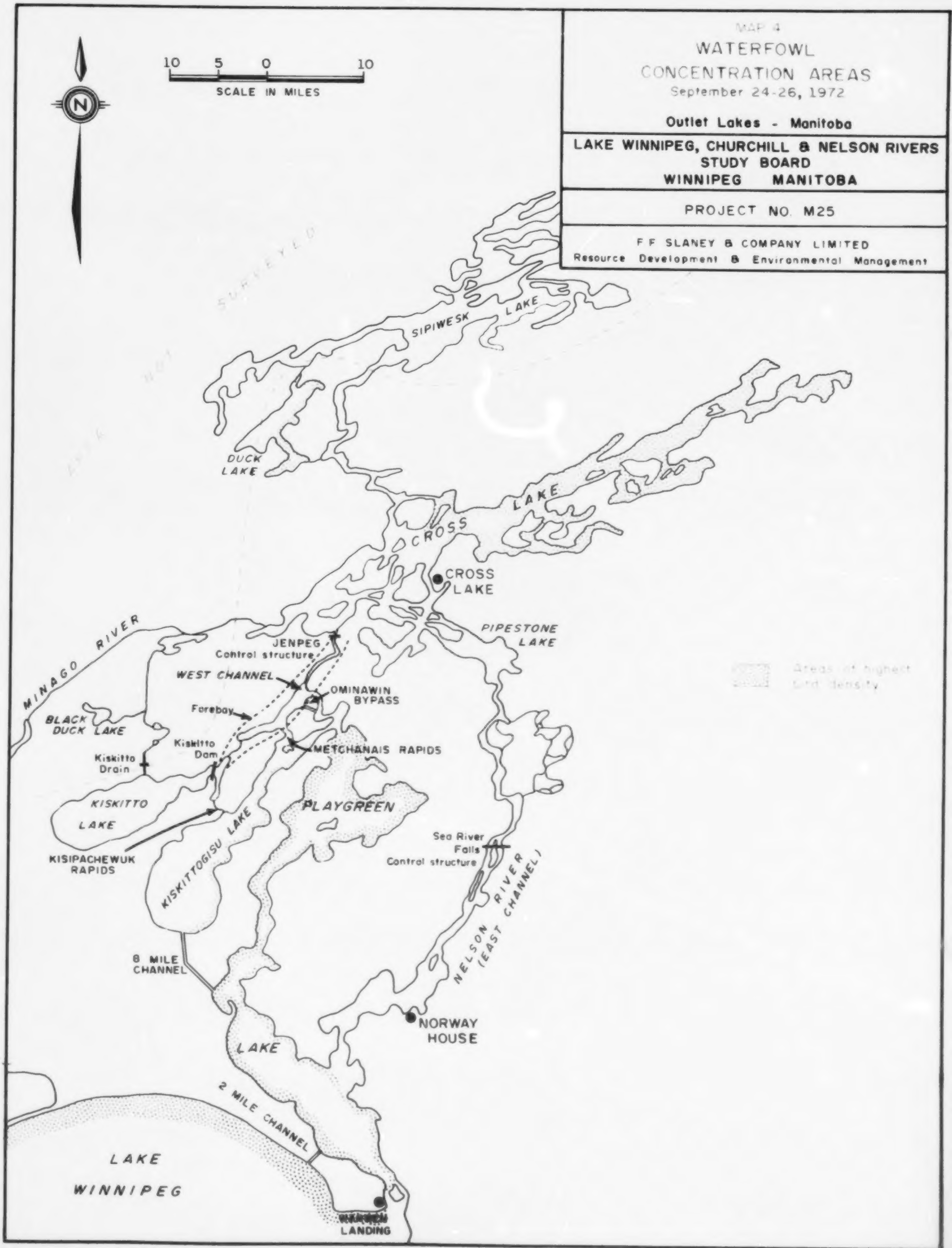
Diving ducks reported in the Study Area include: the ring-necked, lesser scaup (possibly greater scaup; Vermeer 1972), common goldeneye and several species of merganser. Lesser scaup are the most abundant species and have been reported breeding in large numbers. During fall migration large concentrations of scaup (presumably lesser) were observed on Cross Lake (19,000) and Playgreen Lake (10,000) Map 4.

Diving ducks are less dependent in the fall on shallow marshy areas than dabbling ducks, utilizing waters of intermediate depth where they feed on aquatic vegetation (Potamogeton sp.). Shoreline types most attractive in fall are the low willowed shoreline and low shoreline in coarse sediments. Such shorelines are especially common on Upper Playgreen and Cross Lakes (Table 1).

Lesser scaup nest near the water on low grassy shorelines. The other common breeders use rocky niches or tree cavities.

6.1.3.2 Human Utilization of the Waterfowl Resource

Complete licensed hunter harvest statistics were not available for a single year. During 1969, 50,568 bird licenses were sold by the Manitoba government to 47,966 resident hunters and 2602 non-residents. Of this total it is estimated that 41,611 hunters took part in a harvest of 444,372 ducks and 38,083 geese. Individual hunters expended an average of 7.1 days afield and took an average daily bag of 2.3 waterfowl, for a mean seasonal bag of 14.9 birds. A total of 295,438 man days was spent in the pursuit of waterfowl. Of the ducks harvested during 1969, 58.8 percent were mallards and 8.5 percent were lesser scaup. The remainder of the harvest was comprised of a number of species in smaller amounts.



MAP 4
WATERFOWL
CONCENTRATION AREAS
September 24-26, 1972

Outlet Lakes - Manitoba

LAKE WINNIPEG, CHURCHILL & NELSON RIVERS
STUDY BOARD
WINNIPEG MANITOBA

PROJECT NO. M25

F F SLANEY & COMPANY LIMITED
Resource Development & Environmental Management

N
10 5 0 10
SCALE IN MILES
AREA NOT SURVEYED
SIPIWESK LAKE
DUCK LAKE
CROSS LAKE
CROSS LAKE
PIPESTONE LAKE
MINAGO RIVER
JENPEG Control structure
WEST CHANNEL
OMINAWIN BYPASS
Forebay
BLACK DUCK LAKE
Kiskitto Drain
Kiskitto Dam
METCHANAIS RAPIDS
KISKITTO LAKE
PLAYGREEN
KISIPACHEWUK RAPIDS
KISKITTOGISU LAKE
Sea River Falls Control structure
NELSON RIVER (EAST CHANNEL)
8 MILE CHANNEL
NORWAY HOUSE
LAKE
2 MILE CHANNEL
LAKE WINNIPEG
WARREN LANDING
Areas of highest bird density

While the percentages vary somewhat from year to year, mallards and scaup generally comprise over 60 percent of the total kill. Data for 1965 are included in Table 7b.

TABLE 7b

REPORTED DUCK HARVEST IN MANITOBA - 1965

Ducks	Percent
Mallard	53.5
Gadwall	3.2
Pintail	4.4
Green-winged Teal	3.1
Blue-winged Teal	7.3
American Widgeon	1.2
Shoveler	4.5
Redhead	1.8
Ring-necked Duck	.6
Canvasback	2.8
Scaup spp.	15.1
Common Goldeneye	.9
Bufflehead	1.1
Ruddy Duck	.5
	100.0

Three goose species were represented in the 1969 bag: Canada goose 63.4 percent, snow (blue) goose 31.2 percent, and white-fronted goose 5.4 percent. Annual kills for the latter two species vary considerably from year to year depending upon the timing and location of their fall migration through the province. Canada geese from local and arctic nesting populations are the mainstay of the Manitoba goose hunt.

No waterfowl harvest data are available for the Outlet Lakes. In perspective, it seems that the role the Outlet Lakes area plays in the overall provincial hunt is determined by its general inaccessibility. It is within Game Bird Management Unit No. 1, a vast area comprising most of the northern two-thirds of the province. Within this unit during 1963, 2.9 percent of the duck harvest and 14.6 percent of the goose harvest took place. It was calculated the management unit that year was subject to only 0.8 percent of the total hunting pressure generated in the province. In 1965, only 0.7 percent of the total hunter days were expended in this unit.

Most geese taken in the management unit are killed along the Hudson Bay coastline where large concentrations of northern nesting birds occur each fall. Very few are taken in the Study Area by licensed hunters. Major duck harvest areas in the north are near The Pas. Licensed hunter harvests of ducks in the Outlet Lakes must be very low.

Ducks and geese are utilized to an unknown degree by non-licensed Treaty Indians.

The Outlet Lakes region appears to play only a minor role in the provincial waterfowl utilization picture. The lesser scaup of the area may contribute to a harvest normally obtained in Whiteshell Park, but other species are too few in number to greatly add to hunter opportunity anywhere in southern Manitoba.

6.1.3.3 Diving, Colonial and Fish Eating Birds

Loons

The common loon is the only loon species that occurs regularly and breeds in the area. It is a fish eating, diving bird which depends on shorelines for nesting. Islands are particularly important. Nesting shoreline requirements are specialized because of the loon's relative inability to move on land.

Grebes

Red-necked, horned and pied-billed grebes are reported to occur in the Outlet Lakes area. These diving birds depend primarily on aquatic invertebrates for food and require marshy shorelines for both feeding and nesting. Nests are in most cases floating structures held in place by emergent aquatic vegetation. Red-necked and horned grebes sometimes breed in loose colonies but the pied-billed grebe is most often solitary. The Study Area has not been reported to support particularly large breeding colonies or to be the site of large migratory concentrations. The area does, however, represent relatively good habitat for all three species (Photos 3 and 8).

Pelicans

The white pelican is a large, colonial nesting, fish eating bird that breeds in Lake Winnipeg. Its breeding range has not been observed to extend into the Canadian Shield. Pelicans have been observed feeding on both Kiskitto and Kiskittogisu Lakes during the months of June and July but no colonies have been reported. These may have been non-breeding wanderers or breeding birds from a nearby colony which flew into the area to feed. The latter is thought unlikely as the nearest known colonies are 100+ miles distant (Vermeer, 1970). The Outlet Lakes area cannot, in the light of present information, be considered critically important to white pelicans.

6.1.3.4 Birds of Prey

A number of birds of prey occur in the area including eagles, ospreys, hawks, and owls. Species in the latter two groups are essentially birds of the forest. Bald eagles and ospreys nest in large trees near water and depend on fish for food. Large numbers of these birds have not been reported but shoreline habitat appears suitable.

6.1.3.5 Cranes

Sandhill cranes have been reported breeding in muskeg areas south of Kiskittogisu Lake (Photo 11). Numbers are low. These birds may belong to a subspecies thought to be rare in Manitoba, the greater sandhill crane, (*Grus canadensis tabida*). This problem is complicated by the recent description of a "new" subspecies *G. c. rowani* the Canadian sandhill crane (Walkinshaw, 1965) to which Outlet Lake birds could refer.

Breeding ranges of both G. c. canadensis (lesser sandhill crane) and G. c. rowanii touch on the present Study Area according to Walkinshaw (1965), while that of G. c. tabida extends only into the southeastern corner of Manitoba.

However, a report by Stephens (1970) questions the validity of the entire subspecific taxonomy based on results obtained from a study of sandhill cranes in Saskatchewan. Additional study is required to determine the precise taxonomic standing of Outlet Lakes resident birds.

6.1.3.6 Other Birds

Other bird species of interest include marsh dwellers such as rails and coots, several shorebirds, gulls, terns, kingfishers and a number of songbirds.

Rails and coots require marsh shorelines for both feeding and nesting activities.

Breeding shorebirds found in the area generally do not utilize open shore habitats, preferring smaller ponds in wooded areas.

South of the Study Area, gull and tern colonies are found on suitable islands, especially in larger lakes. Colonies have not been reported in the Study Area although their existence can be expected. Franklin's gulls and black terns may nest in marshy areas along shorelines.

Belted kingfishers and several passerine species including marsh wrens, blackbirds and certain sparrows use marsh habitats in the area.

6.2 IMPACT OF DEVELOPMENT

In the absence of completed bio-physical and shoreline reports, basic water level data provided by Manitoba Hydro through the Study Board were interpreted in terms of anticipated physical effects upon water bodies and shoreline environments. Table 8 depicts those effects. This process of predicting the extent and frequency of physical effects of water upon lake turbidity, sedimentation rates and shoreline soils and vegetation proved difficult for many reasons, not the least of which was the general lack of flood line contours. As a result, some interpretations will be subject to change as further information is received and analyzed.

Table 8 also outlines the most significant wildlife involvements that can be predicted on the basis of existing knowledge.

The extent and significance of many of the predicted wildlife involvements are not clearly evident because of lack of information of the proper type. Nevertheless, speculative statements have sometimes been made on the basis of indirectly related data, so that at least a preliminary appreciation of resource values would be possible.

This part features discussion of those involvements.

6.2.1 West Channel and North end of Kiskittogisu Lake

Approximately 26 square miles of Class 2 moose habitat will be inundated within the forebay. An additional 11.1 square miles of Class 3 and 4 habitat will be lost. On the assumption that all habitat is currently being used at capacity, animals utilizing the flooded areas will be lost to the population, even though they will initially respond by moving to adjacent areas.

Survey data suggest a base population of about 20 moose will be permanently lost. Capability figures indicate that 38-45 animals would be removed from the production base.

Aquatic furbearers presently inhabiting shoreline to be flooded will be displaced. Some species such as beaver may adapt to higher water levels, but muskrat and others will be unable to exist until new marshes form. Mink are associated with several shoreline types along the West Channel and therefore will be affected.

Two traplines will be affected - Cross Lake RTL No. 25 and Norway House RTL No. 25. Over the past five years two trappers have trapped the Norway House line for an average return of $946 per year. Mink was the most important species trapped in four out of five years. Two trappers have also utilized Cross Lake RTL No. 25 during the past five years. That line averaged a yearly return of $472, with beaver and mink the important species. A major portion of each trapline will be adversely affected.

Of the 128 miles of shoreline only 14 are bordered by marsh areas. Of these, eight have limited capacity to support waterfowl and six represent good marsh habitat. Much of the existing marsh will be destroyed through alternate flooding and drawdown. The low numbers of waterfowl using the area will be adversely affected.

Complete timber clearing to the approximate floodline is expected to speed up the formation of new shorelines. To the limited degree that occurs, reduction in long-term effects will be accomplished.

6.2.2 Cross Lake

Winter water release with subsequent open water could affect the movements of caribou but the potential significance of that possibility is deemed small. Similarly, access to moose winter browse along shorelines would be made difficult. High winter water levels will flood out muskrat and beaver houses constructed at low fall water levels. Percent losses of this nature will be high.

Shoreline trapping will become hazardous and difficult with reduced availability of mink, beaver and muskrat. Approximately 20 RTL's are known to be affected, while seven other lines may be affected depending on the final flood contour line. The five year average dollar return per trapline for the 20 to be affected is $2491. The same average for the seven lines that might be affected is $1702. The 20 lines are used by an average of 100 trappers per year. The seven "possible" lines average 16 trappers per year.

Cross Lake has extensive marshy shores totalling some 241 miles. Of these, 201 lie off bedrock shorelines and have limited capacity as waterfowl habitat. The remaining 40 miles are judged to be good marsh habitat that likely support moderate densities of nesting waterfowl. The whole 241 miles are

NOTE: *Information concerning proposed flow cutback during the freeze up period at Jenpeg was obtained subsequent to the writing of this report and therefore was not included in the above assessment.*

used extensively during fall migration as resting and staging areas (Photo 12). Moderate to high numbers of staging mallards, scaup and Canada geese were observed during fall migration 1972 Map 4.

A water regime of high water during winter and low water during summer should not have detrimental effect upon marsh plants and in fact may encourage their development. Winter ice scouring however, could remove large permanent marsh plants such as bulrushes from fast flowing reaches in the western end. Smaller, quickly growing species (Carex spp.) should flourish on summer exposed bottom sediments and may not be removed by ice. These factors will act to maintain or enhance the lake's suitability to waterfowl. Rising water levels in fall, flooding new marsh growth, might create feeding conditions ideal for scaup, mallards and other ducks. Nesting islands will become larger, possibly creating improved nesting conditions for Canada geese. The extreme summer maximums expected will infrequently cause nest losses.

6.2.3 Kiskittogisu Lake

Aquatic furbearer populations, especially muskrat, will experience freeze-out due to winter drawdowns. House construction will be tailored to fall water levels and subsequent drawdowns of up to six feet will leave them exposed.

Ungulates accustomed to using the lake ice for travelling, e.g., caribou, may not use travel routes due to hanging ice.

Two traplines will be affected - No. 39 and No. 25 (discussed in Part 6.2.2). About 50 percent of No. 39 will be adversely affected. Average yearly fur return has been only $40, accrued to one trapper yearly.

Little waterfowl breeding habitat is present along shorelines of the southern part of Kiskittogisu Lake. Only 3.5 miles of a total 74 support marsh vegetation. The lake does however, have some offshore areas and shoreline judged by CLI to be potentially valuable as migration staging areas. These low lying onshore and offshore areas will be alternately flooded and exposed through fluctuating water levels with detrimental effects on aquatic vegetation. Moderate numbers of migrating whistling swans, scaup, mallards and Canada geese were observed using the area last fall, and could be partially displaced. Waterfowl and other birds using the marshes for nesting will have difficulty doing so. Numerous nesting islands may be inundated.

6.2.4 Playgreen Lake

Muskrats in marsh areas along the shoreline will be lost due to raising of mean water levels. Stabilization of water levels will probably prevent extensive marsh regeneration;therefore muskrats may not recolonize in similar numbers at new levels.

Two traplines will be affected - Norway House RTL's No. 1 and part of No. 26. RTL No. 1 is a community trapline utilized by about 80 trappers per year. During years of low pelt prices muskrat are the most important furbearers, but during years of high pelt prices mink and beaver are the main species trapped.

The average yearly return over the 5 year period 1966 - 1972 was $9,777.

Of the 48 miles of marsh in existence, half are not well developed and half comprise fair to good marsh habitat. Waterfowl will continue to use these areas for fall staging, but at reduced levels. Fall use by scaup and other ducks was moderately high in 1972 (Appendix 4).

Numerous small islands throughout the lake will be affected. Depending upon their present height above water some will be reduced in size while others will disappear. This will remove nesting habitat for waterfowl.

6.2.5 Eight Mile Channel

One trapline will be affected - Norway House RTL No. 39 (Part 6.2.4)

The cutting of the eight mile channel and associated dredge spoil deposition will create short term disturbance to nesting waterfowl and possibly sandhill cranes. Spoil deposition and later flooding will remove high capacity waterfowl lands from use. Unless replaced, waterfowl use will diminish. Downstream flows will carry additional sediment loads into Kiskittogisu Lake. Increased turbidity in the lake could cause reductions in submergent vegetation, limiting food production for staging waterfowl.

6.2.6 Two Mile Channel

Caribou movements could be affected during the construction phase. A small number of caribou apparently cross the channel location during late fall and early winter. Post-construction activity should not deter movements.

The channel will cut through areas rated as having moderately good production potential for waterfowl but losses will be small. Initially, erosion may cause increased sediment loads in Playgreen Lake, producing a reduction in submergent plant growth. Spoil deposition adjacent to the channel will not cover extensive areas of habitat.

6.2.7 Ominiwan By-pass

Increased flows through the Ominiwan By-pass should not directly affect avian habitat or populations. A small amount of Class 3 moose and caribou habitat will be altered.

6.2.8 Kisipachewuk and Metchanais Rapids

Increased flows through Kisipachewuk and Metchanais Rapids should not directly affect avian habitat or populations. White pelicans have been reported feeding at the lower rapids, but these birds likely represent a transient, non-breeding portion of a Lake Winnipeg population not closely dependent upon any one part of the Outlet Lakes.

6.2.9 Sea River Falls

Some muskrats and mink will be lost if marshy borders and channels downstream are allowed to deteriorate. Norway House RTL No. 1 would be affected to an unknown degree (Part 6.2.4).

Waterfowl using the 104 miles of marshy shoreline in the East Channel could be partially displaced by greatly reduced flows or alternately by reservoir situations above the control structure. Below the structure, side channels supporting shallow marshes may dry up and mallard nesting and feeding areas reduced in value. Above the control structure existing marshes could be flooded but with mildly fluctuating water levels new marshes should develop.

6.2.10 Kiskitto Lake

Caribou calving on islands within the lake will not be affected.

Nesting islands in the lake will be flooded less often and fewer waterfowl nests will be affected by spring floods. Some stagnation and loss of desirable marsh plants may take place if water regulation is maintained within too narrow a margin. Erosion could take place along Black Duck Creek as flows from the lake are increased.

6.2.11 Increased Access

Greater harvests of ungulates will occur when access roads are open to the public. Utilization by licenced hunters will increase. Similarly, increased opportunity for viewing ungulates will be provided. Additional access will also allow greater utilization of ungulates by native people. Harvests could exceed 20 percent of the standing crop in local areas, without restrictions.

There will be improved opportunity for harvesting waterfowl if habitat conditions remain within the range desirable to these migrant birds.

6.2.12 Increased Human Activity

Ungulates will avoid high use areas during the construction phase, (Photo 14) while bears could be attracted to camps. Both ungulates and bears will be subjected to local hunting pressure by construction personnel during the construction phase of the project.

6.3 POSSIBLE MITIGATION PRACTICES

In Table 8, a series of actions are proposed that would lessen the effect of hydro development in the Outlet Lakes on wildlife resources and wildlife utilization patterns. Practices are feasible in that they are capable of implementation. It is recognized however, that any decision to implement must be based on socio-economic and other evaluations at least partially derived from input received from other sources.

This section discusses the major types of mitigation practices that are listed in Table 8 and otherwise deserve consideration.

6.3.1 Primary Alternative

The most certain way to lessen hydro development impact is to not undertake the development proposition expected to cause the impact, or secondarily, to relocate in an area where impact would be less. This option is feasible in the Outlet Lakes region only so far as the Sea River Falls structure is concerned.

6.3.2 Modification of Proposed Regimes

Changes in water levels and flows from those optimal from an engineering standpoint, may reduce wildlife resource impact and enhance wildlife values. These changes may be possible using planned structures, or may require structures redesigned to provide additional water level control capability. The general purposes would be to either induce fluctuations or to modify them. It seems feasible to consider this general procedure for Cross Lake, Kiskittogisu Lake, the East Channel and Kiskitto Lake.

TABLE 8

WILDLIFE ISSUES AND SOME MITIGATION POSSIBILITIES - OUTLET LAKES

COMPONENT/RESULT OF MANITOBA HYDRO PROGRAM	PHYSICAL EFFECT	GREATEST WILDLIFE INVOLVEMENT	SOME MITIGATION POSSIBILITIES
A. JENPEG CONTROL STRUCTURE	A1. Inundation of about 24,000 acres of land identified on the west channel of the Nelson River and upper Kiskittogisu Lake.	A1. Over 70% of the area inundated along the west channel and upper Kiskittogisu Lake has only slight limitations to the production of moose according to the Canada Land Inventory rating system. Extensive marshes occur in upper Kiskittogisu Lake and are attractive to migrating waterfowl and aquatic furbearers. Traplines in the Jenpeg forebay will be affected.	A1. Clear a border 100 to 200 feet wide above the new water level to allow the development of willow and dogwood for purposes of moose browse. Provide alternate opportunity or compensation to trappers for loss of income from flooded portions of their traplines.
	A2. Cross Lake. Under regulation, water levels about 1½ feet above the recorded historical maximum will occur during the summer months. Following freeze-up, water levels may rise up to 4 feet. Lake levels in general, will fluctuate in an erratic manner. An undetermined amount of acreage adjacent to shorelines will be inundated during the summer.	A2. Large numbers of waterfowl utilize Cross Lake as a staging area in the fall. An unknown number of ducks and geese breed there. Both breeding and staging would be affected by inundation on Cross Lake. About 20 registered traplines may be affected. Muskrat and beaver populations associated with the lake would decline due to winter flooding and fluctuating water levels. An unknown amount of ungulate habitat would be flooded.	A2-A3. Alter the projected regime so that extreme changes in water level will be avoided. Remove standing timber around newly created islands to facilitate the establishment of natural shorelines for use by waterfowl and aquatic furbearers. Provide alternate opportunity or compensation to trappers for income loss.
	A3. Kiskittogisu Lake. Under regulation lake levels will reach maximums about 2½ feet above recorded historical maximums. An undetermined amount of land in low lying areas will be inundated. Rapid and extreme increases in lake levels will occur in the spring. Winter drawdowns up to 6 feet will occur.	A3. Waterfowl and aquatic furbearer habitat associated with shoreline marshes would be lost. Waterfowl nesting adjacent to shorelines will be inundated. The usefulness of the lake as a summer staging area for scoup may be reduced through changes in aquatic vegetation. Winter drawdowns will be detrimental to muskrats. Traplines associated with the lake will decrease in productivity.	
	A4. Playgreen Lake. Under regulation mean water levels on Playgreen Lake will be within historical levels but about 2½ feet higher than average. Lake levels will be stabilized - extreme highs and lows will not occur.	A4. Aquatic and emergent vegetation utilized by waterfowl, particularly during migration, and muskrats may be affected due to loss of flushing of marsh areas. Losses to trapping may occur.	A4. Regulate water levels to allow for occasional large drawdowns and increases to stimulate growth of aquatic and emergent vegetation. Introduce wild rice or some other substitute waterfowl food. Provide alternate opportunity or compensation to trappers for income loss.
B. WATER FLOW IMPROVEMENTS	B1. Water flow from Playgreen Lake to Kiskittogisu Lake will be improved through dredging of an eight mile by-pass channel. Dredge spoil material will be deposited adjacent to the channel and in the Kiskittogisu River.	B1. The channel and dredge spoil deposition area will both affect an area of some importance to waterfowl and ungulates. The eight mile channel area south of Kiskittogisu Lake has been rated as an area with only slight limitations to the production of waterfowl and an important waterfowl staging area according to Canada Land Inventory capability ratings. Sandhill cranes probably nest in the dredge spoil area. Part of the dredge spoil area has moderately high capability for the production of moose according to C.L.I. maps. The area recently has not produced large numbers of furs according to trapline records. Any traplines currently on the Kiskittogisu River will be lost.	B1. Contain dredge spoil material behind the lateral dyke on the south side of the channel. Dyke along current shoreline of Kiskittogisu Lake, to be constructed and maintained. Islands to be constructed in dirt-spoil material that will be periodically flooded; for the purpose of duck and goose nesting.
	B2. Water flow from Lake Winnipeg to Playgreen Lake will be improved through dredging of a two mile by-pass channel. Dredge spoil material will be deposited adjacent to the channel.	B2. A woodland caribou migration pathway between Lake Winnipeg and Playgreen Lake may be affected.	B2. General actions only. (See Footnote).
	B3. Water flow from Kiskittogisu Lake to the west channel of the Nelson River will be improved through excavation of a by-pass channel (Ominiwan By-pass). The excavated material will be deposited adjacent to the channel.	B3. An undetermined amount of ungulate habitat of moderate to low capability will be covered with excavated material.	B3. General actions only.
	B4. Water flow over Kisipachewuk and Matchanais Rapids will be improved by removal of bedrock from the channels.	B4. The rapid areas are observed feeding areas for white pelicans during the summer months. These pelican feeding areas may be disturbed by rapids removal.	B4. General actions only.

TABLE 8 -Page 2

COMPONENT/RESULT OF MANITOBA HYDRO PROGRAM	PHYSICAL EFFECT	GREATEST WILDLIFE INVOLVEMENT	SOME MITIGATION POSSIBILITIES
C. SEA RIVER FALLS CONTROL STRUCTURE	C1. Downstream flows will be greatly reduced and/or of an irregular nature. Some smaller channels will probably become dry. Marsh borders will receive little or no water and willow type shorelines will invade marshy areas. The willow types will eventually be replaced by conifers.	C1. Waterfowl currently attracted to the marsh type vegetation associated with the slow moving East Channel will be less likely to use the area due to the altered habitats created by reduced flows. The reduced amount of marsh will also create less favourable conditions for muskrats, mink and beavers. Currently the East Channel area is an important trapping area for residents of Norway House.	C1. Primary alternative is not to construct Sea River Falls structure. If the structure is built, a study is required to determine proper regime to release enough water to maintain marsh habitat down-stream. These releases should be no greater than maximum recorded flows. Provide alternative opportunity or compensation to trappers for loss of potential trapping income.
	C2. The moving, fluctuating river flows will be replaced by a closely regulated reservoir situation. It is not known if any shoreline flooding will occur. With stabilization of water levels, the riparian vegetation will largely be replaced by conifers.	C2. Stabilized water levels at a high level above Sea River Falls would be detrimental to marshes and would adversely affect waterfowl and aquatic furbearers utilized by Norway House residents.	C2. Primary alternative is not to construct Sea River Falls structure. Provide alternative opportunity or compensation to trappers for loss of potential trapping income.
D. KISKITTO LAKE REGULATION	D1. Water levels on Kiskitto Lake to be maintained within its natural range of fluctuations. Levels will be approximately 2 feet above the historical mean. Severe fluctuations will be eliminated. Natural inlet from west channel controlled by a dam. Inflows from Stan Creek to be provided and a gated culvert from west channel will suplement inflow during periods of low water.	D1. An unknown number of waterfowl, particularly geese, are known to nest on islands in Kiskitto Lake. Caribou utilize islands in the lake as calving areas. The status of furbearer populations associated with the lake are not known. The current exploitation scale is low.	D1. Require outlet structure with flexibility to reduce water levels in late summer and again by spring, if required. Ducks unlimited should be asked to assume management responsibility for lake levels. A combined wildlife-fisheries study should be established and implemented for the purpose of determining optimum regulation.
	D2. Kiskitto Lake outflows will be diverted into Black Duck Creek and then into the Minago River through a drainage channel and control structure. Some erosion will probably occur on Black Duck Creek due to increased discharges.	D2. Erosion along Black Duck Creek will probably cause increased sediment loads in Black Duck Lake. Little is known about wildlife along this drainage route.	D2. Introduce aquatic food plants for waterfowl into Black Duck Lake.
E. INCREASED ACCESS (roads, airstrips, boating)	E1. All Weather Road Construction Existing - Jenpeg access road. Jenpeg to Kiskitto Lake. Proposed - Jenpeg to Cross Lake. Possible - Jenpeg to Norway House. Air Strips Existing - Jenpeg 8-mile channel Proposed - 2 mile channel Possible - Sea River Falls. Marine Traffic Boat traffic through West Channel via Ominawin by-pass to Cross Lake.	E1. Many game animal populations will become more accessible. Moose and caribou harvests will probably increase. Increased opportunity for harvest of migrating waterfowl will occur.	E1. Establish management procedure to regulate moose and caribou harvest in local areas around communities.
F. INCREASED HUMAN ACTIVITY (associated with construction and operation of works)	F1. There will be construction camps located at Jenpeg, eight-mile channel, Kiskitto Lake and Sea River Falls. The construction and servicing of these camps by road, aircraft and boat will cause local disturbances to wildlife populations. Hunting by construction workers will also effect wildlife near these camps.	F1. Aquatic furbearers and waterfowl near the camps will be displaced by construction activity. Moose and caribou will also avoid high use areas. Increased utilization of game species, particularly waterfowl and ungulates, can be expected through hunting by construction workers.	F1. Establish acceptable incineration methods for garbage disposal. Instruct charter and government aircraft pilots to operate in such a way as to avoid harassment of wildlife. Regulate hunting by construction workers to reduce kill of moose and caribou in areas easily accessible to residents of Norway House and Cross Lake.

* Contain dredge spoil in minimal area and revegetate where required to stabilize materials.

6.3.3 Determination of Optimal Water Regimes

Insufficient data generally exists in the Outlet Lakes to permit prediction of optimal water flows and levels in terms of effect upon vegetation important to wildlife. It was clearly beyond the scope of this study to ascertain what those levels might be for any part of the Outlet Lakes. Although rough estimates can be made when time permits no other alternative, it would seem more appropriate to undertake studies as a basis for design of a manipulation program. Establishment and co-ordination of those studies should be the purview of an ad hoc committee of provincial, federal, Ducks Unlimited, Study Board, wildlife and where applicable, fishery representatives. Continued management input will be required to satisfy wildlife and fishery interests in at least Kiskitto Lake. It is suggested that Ducks Unlimited, Canada could be asked to accept the responsibility for lake level management at Kiskitto.

6.3.4 Trapping Losses

Significant short and possibly long term losses of income from trapping will occur in the forebay region, Cross Lake, Kiskittogisu Lake, Playgreen Lake, and the East Channel. Mitigation against that loss could involve either direct compensation or the provision of equivalent alternatives. Compensation could involve a monetary return based on the average yearly RTL return calculated over the five year period 1966-1971 inclusive, and based on Winnipeg fur prices. It is recognized that present fur prices are higher than in any year of that five year period. Conversely, Winnipeg fur prices are considerably above the actual prices received by the trappers from local fur dealers.

Compensation could be based on the percent of each trapline adversely affected as determined from flood contour lines when available.

Fur administration procedures should be amended so that RTL's affected at or near the 100 percent level are deleted from the RTL sections when the present trapper ceases to use the line. No transfer rights should be allowed. Lines affected to a lesser degree would be treated in the same manner on a proportionate basis.

A better method of mitigating against potential fur return losses is to make available some equivalent opportunity to affected trappers for the purpose of replacing lost income. For example, trapping privileges could be granted on unaffecred traplines that are currently underutilized. Some of the larger RTL's could possibly be subdivided to accommodate displaced trappers. Perhaps alternative employment in other resource based industries could be offered. Other areas of employment could include pulp cutting, timber clearing in reservoirs or for rights-of-way, mining, etc.

Another alternative that could be undertaken would be to improve trapping efficiency on the remaining trapping areas not adversely affected by the hydro development. Assistance could be in the form of educational programs to upgrade fur handling and quality, financial assistance to establish line camps or to purchase equipment such as snow machines, traps and stretchers, the establishment of fur co-operatives in order to obtain higher pelt prices, and perhaps federal-provincial agreement on tax rebates with regard to primary costs related to trapline operation and maintenance.

6.3.5 Timber Clearing

In the forebay region an additional 150-foot swath of timber could be cleared above the floodline in order to promote the production of ungulate food that will be lost on Class 2 capability lands within the reservoir. Similarly, removal of standing brush and timber around newly established shorelines on existing or newly created islands,to facilitate the establishment of natural shorelines for use by waterfowl and aquatic furbearers would seem to be feasible on Cross Lake and Kiskittogisu Lake. Identification of those shorelines would have to be precise in order to minimize any conflict with caribou calving values on the larger islands.

Cut trees and slash should be windrowed to provide temporary wildlife cover above floodlines. This procedure could also be followed in dredge spoil areas along the eight and two mile channels.

6.3.6 Introduction of Food Plants

The introduction of wild rice, if it is not already present, may partially compensate for long term losses in marsh vegetation brought about by stabilized water levels or changes in turbidity and sedimentation in Playgreen Lake and Kiskitto Lake.

6.3.7 Treatment of Dredge Spoil

Dredge spoil from the Eight Mile Channel operation may have less impact upon waterfowl lands if contained behind a dyke on one side of the channel - preferably the west side. Consideration should be given to revegetating spoil areas that may be exposed to erosive effects of water, in order to stabilize sediments and reduce turbidity in Kiskittogisu and Playgreen Lakes.

6.3.8 Island Construction

Construction of small islands in areas adjacent to the Eight Mile Channel that will be periodically surrounded by water could compensate in some degree for potential losses of waterfowl production. Several species of ducks and perhaps Canada geese would nest on the islands. Similarly, the blasting of small potholes in upper reaches of the dredge spoil area might improve the region's capacity for waterfowl production.

6.3.9 Traditional Nesting Trees

Wherever reservoir and channel clearing takes place,an attempt should be made to identify and to leave standing traditional nesting trees for ospreys and bald eagles. They are readily identified by the existence of old nests.

6.3.10 Embayments

In some portions of Cross Lake, Kiskittogisu Lake and Playgreen Lake, marsh conditions could be improved in certain bays and backwaters by the provision of dykes with simple control structures. These areas would require identification. They would also require satisfactory arrangements for future management and control of game harvests.

6.3.11 Game Harvest Control

While improved access in the Outlet Lakes area will be of general benefit through increased opportunity for consumptive and non-consumptive utilization of wildlife crops, local overharvests by licenced hunters can be anticipated near settlements, camps and along roads. Treaty Indians will contribute to these local "burnouts". While not serious in themselves, the role played by licenced, non-local hunters may be resented by resident people. Management procedures should be considered to prevent or regulate kill of big game in easily accessible regions by licenced hunters. This should include construction workers and other camp residents.

6.3.12 General Camp Provisions

Proper incineration of refuse and litter would reduce the attraction of camps to bears and therefore minimize bear-people problems.

A program of education and perhaps regulation would seem necessary to prevent undue harassment of waterfowl, ungulates and bears around camps, by aircraft, and along travel routes.

PART 7

APPENDICES

APPENDIX 5

MOOSE TRANSECT SURVEY FLIGHT DATA

	November 25, 1972.	November 26, 1972.
Temperature	0°F	-10°F
Wind	NW-5	NW-13
Ceiling	1000'	600'
% Cloud	100	100
Precipitation	light snow	light snow
Air speed	80 m.p.h.	80 m.p.h.
Altitude	600'	600'
Transect width	¼ mile	¼ mile
Flight times	1.3 hours	3.3 hours

Aircraft - Beaver

Personnel - Pilot plus two observers (B. MacDonald, R. Urban).

APPENDIX 6

VALUE OF MOST IMPORTANT FUR SPECIES - CROSS LAKE R.T.L. 1966 - 67
(value in $)

		SPECIES*				
R.T.L. #	No. of Trappers	Beaver	Lynx	Mink	Muskrat	Total
1	3	$ 60.00	$	$ 289.00	$	$ 349.00
2	2	18.00		58.00		86.00
3	1				67.10	67.10
4						
5	1				51.70	51.70
6	4	204.00		663.00	125.40	992.40
7						
8	8	288.00		765.00	45.10	1098.10
9	7	708.00	72.00	1139.00	73.70	1992.70
10	1	30.00		459.00	29.70	518.70
11	1	30.00		136.00	103.40	269.40
12	3	96.00		459.00	38.50	593.50
13	3	24.00		170.00	13.20	207.20
14	3	120.00		595.00	84.70	799.70
15	1	54.00		255.00		309.00
16	1	6.00		17.00	23.10	23.00
17	4	60.00		136.00		196.00
19	1					
20	6	48.00		221.00	91.30	360.30
21	5	18.00		85.00	71.50	174.50
22						
23	2	216.00		221.00	139.70	576.70
24	4	108.00	24.00	85.00	187.00	404.00
25	2				20.90	20.90
26	3	174.00		629.00	30.80	833.80

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		SPECIES*				
R.T.L. #	No. of Trappers	Beaver	Lynx	Mink	Muskrat	Total
27	5	$ 408.00	$ 24.00	$ 765.00	$ 33.00	$1230.00
28	3	18.00		442.00		460.00
29	4	378.00		1071.00	39.60	1488.60
30	5	516.00		714.00	389.40	1619.40
32	2	42.00		119.00	7.70	168.70
33	9	306.00		204.00	13.20	523.20
34	6	42.00		34.00	2.20	78.20
36	1	18.00		238.00		256.00
37	1	120.00		136.00	57.20	313.20
38	5	42.00		204.00	99.00	345.00
40	1					
41	1	6.00		34.00	68.20	108.20
42	3	18.00		153.00	60.50	231.50
43	2					
44	3	6.00		34.00	155.10	195.10
46	1	18.00		221.00	132.00	371.00
48	1					
49	2	84.00		306.00	20.90	410.90
50	1					
51	2	30.00		68.00	77.00	175.00
52	1					
54	3	108.00		136.00	99.00	343.00
55	2	24.00		340.00		364.00
56	46	132.00		697.00	1401.40	2230.40
58	1	12.00		119.00	105.60	236.60
59	2	132.00		85.00	49.50	266.50

		SPECIES*				
R.T.L. #	No. of Trappers	Beaver	Lynx	Mink	Muskrat	Total
B	3	$ 24.00	$	$ 34.00	$ 82.50	$ 140.50
A	1	108.00		153.00	24.20	285.20
D	4	18.00			856.90	874.90
F	1	66.00			30.80	96.80
	188	$4,938.00	$120.00	$12,699.00	$6,945.40	$24,702.40

*Average Winnipeg prices used in calculations as follows: beaver $6.00; muskrat $1.10; mink $17.00; lynx $24.00.

APPENDIX 7

VALUE OF MOST IMPORTANT FUR SPECIES - CROSS LAKE R.T.L. 1967 - 68
(value in $)

		SPECIES*				
R.T.L. #	No. of Trappers	Beaver	Lynx	Mink	Muskrat	Total
1	3	$ 36.00	$	$	$ 21.00	$ 57.00
2	2			64.00		64.00
3	1					
4						
5	1					
6	4	18.00				18.00
7						
8	8			240.00	52.00	292.00
9	7	1044.00		528.00	5.00	1577.00
10	1					
11	1				24.00	24.00
12	3			64.00	14.00	78.00
13	3			80.00	14.00	94.00
14	3	234.00		576.00	15.00	825.00
15	1					
16	1	18.00				18.00
17	4	162.00			22.00	184.00
19	1	18.00				18.00
20	6	252.00			186.00	438.00
21	5	90.00		80.00	98.00	268.00
22					13.00	13.00
23	2				13.00	13.00
24	4	108.00			85.00	193.00
25	2	252.00			8.00	260.00
26	3	180.00			19.00	209.00

APPENDIX 7 - Page 2

R.T.L. #	No. of Trappers	Beaver	Lynx	Mink	Muskrat	Total
		SPECIES*				
27	5	$ 216.00	$ 33.00	$	$	$ 249.00
28	3	270.00		336.00	8.00	614.00
29	4	288.00			18.00	306.00
30	5	774.00			12.00	786.00
32	2			16.00	27.00	43.00
33	9	270.00		160.00	183.00	513.00
34	6			64.00	16.00	80.00
36	1				34.00	34.00
37	1	90.00				90.00
38	5	36.00		90.00	45.00	171.00
40	1				56.00	56.00
41	1					
42	3	360.00			110.00	470.00
43	2			432.00		432.00
44	3	36.00		112.00	12.00	160.00
46	1	270.00		416.00	46.00	732.00
48	1	18.00			10.00	28.00
49	2	36.00			28.00	64.00
50	1	54.00			2.00	56.00
51	2					
52	1	432.00			55.00	487.00
54	3	630.00			15.00	645.00
55	2					
56	46	576.00		272.00	1216.00	2064.00
58	1	18.00		272.00		290.00
59	2					

APPENDIX 7 - Page 3

		SPECIES*				
R.T.L. #	No. of Trappers	Beaver	Lynx	Mink	Muskrat	Total
B	3	$ 36.00	$ 33.00	$ 128.00	$	$ 197.00
A	1	54.00		96.00	5.00	155.00
D	4					
F	1					
	188	$6,876.00	$ 66.00	$4,026.00	$2,487	$13,455.00

*Average Winnipeg prices used in calculations as follows: beaver $18.00; muskrat $1.01; mink $16.00; lynx $32.66.

APPENDIX 8

VALUE OF MOST IMPORTANT FUR SPECIES – CROSS LAKE R.T.L. 1968 – 69
(value in $)

		SPECIES*				
R.T.L. #	No. of Trappers	Beavers	Muskrat	Mink	Lynx	Total
1	3	$ 528.00	$ 57.35	$1088.00	$	$1673.35
2	4	264.00		68.00		332.00
3	1	44.00	23.25	170.00		237.25
4	2	110.00		697.00		807.00
5	4	286.00		340.00		626.00
6	2	176.00	13.95	680.00	41.00	910.95
7						
8	2					
9	11	4070.00		3672.00	574.00	8316.00
10	3	2288.00	187.55	1751.00	287.00	4513.55
11	4	242.00		459.00		701.00
12	1	88.00		255.00		343.00
13	2	286.00	34.10	748.00		1068.10
14	3	1628.00	9.30	1887.00	41.00	3565.30
15						
16	2	286.00	62.00	221.00	82.00	657.00
17	5	330.00	390.60	1173.00	41.00	1934.60
18						
19						
20	7	792.00	193.75	391.00	41.00	1417.75
21	4	308.00	196.85	510.00		1014.85
22	3		32.55	306.00		338.55
23	2	66.00		153.00	123.00	342.00
24	6	306.00	112.80	272.00	41.00	736.80
25	2	132.00	85.00	595.00	164.00	976.00
26	3	306.00	6.00	425.00		737.00

APPENDIX 8 - Page 2

		SPECIES*				
R.T.L. #	No. of Trappers	Beavers	Muskrat	Mink	Lynx	Total
27	5	$2266.00	$ 77.50	$1224.00	$ 451.00	$4018.50
28	1					
29	6	1694.00	10.85	3672.00	123.00	5499.85
30	6	1166	227.85	1785.00	123.00	3301.85
31						
32	1	110.00	30.50	187.00		327.50
33	4	1166.00	66.65	901.00	82.00	2215.65
34	4	572.00	62.00	272.00	41.00	947.00
35	2	66.00		153.00		219.00
36	1	66.00	9.00	102.00		177.00
37	2	154.00	71.30	51.00	41.00	317.30
38	3	748.00	48.05	1190.00	205.00	2191.05
40	2	264.00	165.85	544.00		973.85
41	3	198.00	571.95	544.00		1313.95
42	3	440.00	6.50	280.00	82.00	808.50
43	3	66.00	1.55	408.00		475.55
44						
45						
46	1	308.00	139.50	561.00		1008.50
47						
48	1			51.00	41.00	92.00
49	3	550.00	17.05	561.00	123.00	1251.05
50	1	440.00	3.00			443.00
51	2	22.00		85.00		107.00
52	2	880.00	110.05	612.00		1602.05
53						
54	4	594.00	60.00	1139.00	205.00	1998.00

		SPECIES*				
R.T.L. #	No. of Trappers	Beavers	Muskrat	Mink	Lynx	Total
55	3	132.00	4.50	289.00		425.50
56	46	1870.00	2219.60	4573.00	205.00	8867.60
57						
58	1			187.00		187.00
59	2	308.00	58.90	663.00	41.00	1070.90
60	2	132.00	1.55	408.00		541.55
61						
62						
63	4	638.00	57.35	850.00	246.00	1791.35
64	1					
A	2	220.00	40.30	272.00		532.30
B	3	286.00	51.15	442.00	41.00	820.15
C	1	22.00	20.15	170.00		212.15
D	2	176.00	3.15	85.00	287.00	551.15
E	2	374.00		204.00	533.00	1111.00
F	2		4.50			4.50
G	1	418.00	49.60	255.00	246.00	968.60
	208	$28,882.00	$5,599.95	$38,581.00	$4,756.00	$77,818.95

*Average Winnipeg prices used in calculations as follows: beaver $22.00; muskrat $1.55; mink $17.00; lynx $41.00.

APPENDIX 9

VALUE OF MOST IMPORTANT FUR SPECIES - CROSS LAKE R.T.L. 1969 - 70
(value in $)

		SPECIES*				
R.T.L. #	No. of Trappers	Beaver	Muskrat	Mink	Lynx	Total
1	3	$ 380.00	$ 52.20	$ 260.00	$ 300.00	$ 992.20
2	4	171.00	81.20	195.00	150.00	597.20
3	1	76.00	134.85	78.00		288.85
4	2	969.00		26.00	60.00	1055.00
5	4	380.00		156.00	180.00	716.00
6	2	1463.00	31.90	598.00	540.00	2632.90
7						
8	2	855.00		117.00	120.00	1092.00
9	11	2242.00	37.70	1651.00	1440.00	5370.70
10	3	1121.00	18.85	741.00	450.00	2330.85
11	4	285.00	8.70	91.00	180.00	564.70
12	1	57.00		39.00	60.00	156.00
13	2	133.00	11.60	52.00	120.00	316.60
14	3	551.00	2.90	949.00	330.00	1832.90
15						
16	2	114.00		13.00	30.00	157.00
17	5	95.00	232.00	247.00	330.00	904.00
18						
19						
20	7	418.00	66.70	234.00	150.00	868.70
21	4	76.00		91.00	90.00	257.00
22	3	19.00	120.35	52.00		191.35
23	2	304.00		130.00	120.00	554.00
24	6	380.00	59.45	52.00	270.00	761.40
25	2	171.00				171.00
26	3	247.00	30.45	169.00	30.00	476.45

APPENDIX 9 – Page 2

		SPECIES*				
R.T.L. #	No. of Trappers	Beaver	Muskrat	Mink	Lynx	Total
27	5	$ 988.00	$ 1.45	$1027.00	$ 660.00	$2676.45
28	1					
29	6	969.00	60.90	442.00	240.00	1711.90
30	6	836.00	482.85	377.00	570.00	2265.85
31						
32	1	228.00				228.00
33	4	1140.00	105.85	247.00	750.00	2242.85
34	4	228.00	44.95	26.00		298.95
35	2	152.00	10.85	104.00	60.00	326.85
36	1	76.00	31.90	208.00		315.90
37	2					
38	3	209.00	1.45	76.00	150.00	436.45
39						
40	2	133.00	88.45	143.00	210.00	574.45
41	3	133.00	287.10	119.00		589.10
42	3	171.00	23.20	104.00		298.20
43	3			39.00		39.00
44						
45						
46	1	76.00	42.05	104.00	390.00	612.05
47						
48	1					
49	3	152.00		156.00	150.00	458.00
50	1	95.00		130.00	90.00	315.00
51	2	57.00				57.00
52	2	57.00		91.00	30.00	178.00
53						
54	4	684.00	44.95	273.00	360.00	1361.95

R.T.L. #	No. of Trappers	SPECIES* Beaver	Muskrat	Mink	Lynx	Total
55	3	$ 133.00	$	$ 143.00	$ 60.00	$ 336.00
56	46	1140.00	938.15	923.00	450.00	3451.15
57						
58	1	95.00	4.35	26.00		125.35
59	2	209.00	223.30	285.00	300.00	1017.30
60	2	95.00	4.35	39.00	60.00	198.35
61						
62						
63	4	665.00	33.35	299.00	930.00	1927.35
64	1	19.00		52.00		71.00
A	2	19.00		91.00	660.00	770.00
B	3	456.00		130.00	150.00	736.00
C	1			52.00	60.00	112.00
D	2	95.00		39.00	1200.00	1334.00
E	2	912.00	29.00	39.00	450.00	1430.00
F	2	133.00	282.75	269.00	600.00	1284.75
G	1				30.00	30.00
	208	$20,862.00	$3,640.15	$12,044.00	$13,560.00	$50,106.15

*Average Winnipeg prices used in calculations as follows: beaver $19.00; muskrat $1.45; mink $13.00; lynx $30.00.

APPENDIX 10

VALUE OF MOST IMPORTANT FUR SPECIES - CROSS LAKE R.T.L. 1970 - 71
(value in $)

	SPECIES*				
R.T.L. #	Beaver	Lynx	Mink	Muskrat	Total Value
1	$ 352.25	$ 59.00	$	$ 26.69	$ 437.94
2					
3	56.36	29.50		194.68	280.54
5					
9	2127.59	413.00	112.00	120.89	2773.48
10					
11	112.72			109.90	222.62
13	14.09	29.50		21.98	65.57
14					
16	84.54	88.50		169.56	342.60
17		29.50		458.44	487.94
19	126.81	147.50		91.06	365.37
20	197.26			480.42	677.68
21		29.50	56.00	160.14	245.64
22	366.34				366.34
24	281.80			274.75	556.55
25	394.52	383.50	56.00	95.77	929.79
26	366.34			157.00	523.34
27				21.98	21.98
28	309.98	29.50	123.20		462.68
29	563.60	59.00	112.00	59.66	794.26
30	281.80	59.00	11.20		352.00
31/57					
32	126.81			386.22	513.03
33	309.98			6.28	316.26

APPENDIX 10 - Page 2

SPECIES*

R.T.L. #	Beaver	Lynx	Mink	Muskrat	Total Value
34	$ 295.89	$	$	$ 42.39	$ 338.28
35				29.83	29.83
36	154.99	177.00	78.40	174.27	584.66
37	267.71			89.49	357.20
40	28.18	383.50		246.49	658.17
41	84.54		33.60	648.41	766.55
42	56.36			157.00	213.36
46	126.81			193.11	319.92
51	28.18				28.18
54	535.42	354.00	12.40	171.13	1072.95
55	112.72	206.50	11.20	97.34	427.76
56	605.87	472.00	212.80	2744.36	4035.03
58	56.36	29.50		73.79	159.65
63	84.54			102.05	186.59
64		29.50			29.50
A		619.50		105.19	724.69
C	56.36	708.00	12.40		776.76
B	422.70	413.00	56.00	135.02	1026.72
D	70.45	324.50	11.20	23.55	429.70
E	450.88	708.00		1.57	1160.45
F	140.90				140.90
	$9,653.00	$5,317.00	$897.00	$7,870.40	$23,737.40

*Average Winnipeg prices used in calculations as follows: beaver $14.09; muskrat $1.57; mink $11.20; lynx $29.50.

APPENDIX 11

VALUE OF MOST IMPORTANT FUR SPECIES - NORWAY HOUSE R.T.L. 1966 - 67
(value in $)

		SPECIES*				
R.T.L. #	No. of Trappers	Beaver	Muskrat	Mink	Lynx	Total
1	57	$ 612.00	$3267.00	$ 544.00	$ 24.00	$ 4,447.00
2	8	156.00	341.00	204.00	24.00	725.00
3	3	18.00	33.00			51.00
4	7	282.00	288.20	17.00		587.20
5	1			272.00		272.00
6	4	90.00	357.50	238.00		685.50
7	2	24.00		17.00		41.00
8	1					
9						
10	3	186.00	302.50	272.00		760.50
11	4	156.00	169.40	255.00		580.40
12	3	210.00	17.60	663.00		890.60
13	3	288.00	259.60	323.00	24.00	894.60
14	3	132.00	86.90	170.00		388.90
15						
16	1					
17	2	198.00	24.20	85.00		307.20
18	1	18.00		34.00		52.00
19						
20	4	246.00	495.00		24.00	765.00
21						
22	4	90.00	258.50	51.00		399.50
23	6	258.00	311.30	68.00	24.00	661.30
24	6	60.00	260.70	34.00		354.70
25	4		103.40	170.00		273.40
26	2		18.70	51.00		69.70

APPENDIX 11 - Page 2

		SPECIES*				
R.T.L. #	No. of Trappers	Beaver	Muskrat	Mink	Lynx	Total
27	6	$ 276.00	$ 295.90	$ 170.00	$ 96.00	$ 837.90
28	1					
29						
30	5	138.00	646.80	833.00		1,617.80
31	1	36.00	93.50			129.50
32	3	174.00	156.20	408.00		738.20
33						
34	3	126.00	9.90	204.00		339.90
35	2	96.00	272.80	68.00		436.80
36	1	18.00	25.30	51.00		94.30
37	1	6.00	30.80			36.80
38	2	90.00	86.90			176.90
39						
40	3	114.00	48.40			162.40
41	1	42.00	13.20			55.20
42	2	102.00	335.50	357.00		794.50
43	4	312.00	193.60	527.00		1,032.60
		$4,554.00	$8,803.30	$6,086.00	$216.00	$19,659.30

*Average Winnipeg prices used in calculations as follows: beaver $6.00; muskrat $1.10; mink $17.00; lynx $24.00.

APPENDIX 12

VALUE OF MOST IMPORTANT FUR SPECIES - NORWAY HOUSE R.T.L. 1967 - 68

(value in $)

SPECIES*

R.T.L. #	No. of Trappers	Beaver	Muskrat	Mink	Lynx	Total
1	98	$2358.00	$5580.00	$2000.00	$33.00	$ 9,971.00
2	8	612.00	802.00	272.00	33.00	1,719.00
3	3	186.00				186.00
4	7	1602.00	162.00	592.00		2,356.00
5	1					
6	4	558.00	199.00	384.00	33.00	1,174.00
7	2					
8	1	486.00				486.00
9						
10	3	864.00	451.00	464.00	33.00	1,812.00
11	4	468.00	103.00	160.00		731.00
12	3	738.00	77.00	16.00		831.00
13	3	612.00	315.00	432.00		1,359.00
14	3	126.00	104.00	112.00		342.00
15						
16	1		158.00			158.00
17	2	126.00	126.00	16.00		268.00
18	1	18.00	35.00	64.00		117.00
19						
20	4	846.00	444.00	304.00	33.00	1,627.00
21						
22	4	558.00	62.00	368.00		988.00
23	6	900.00	193.00	384.00		1,477.00
24	6	540.00	196.00	336.00	33.00	1,105.00
25	4	90.00	90.00	544.00	33.00	757.00
26	2		13.00			13.00
27	6	108.00	70.00	96.00		274.00

APPENDIX 12 - Page 2

		SPECIES*				
R.T.L. #	No. of Trappers	Beaver	Muskrat	Mink	Lynx	Total
28	1	$ 18.00	$ 155.00			$ 173.00
29						
30	5	738.00	825.00	1376.00		2,939.00
31	1	126.00	89.00	208.00	33.00	456.00
32	3					
33						
34	3					
35	2	108.00	113.00	112.00		333.00
36	1	144.00	7.00			151.00
37	1		4.00			4.00
38	2	306.00	77.00			383.00
39						
40	3	450.00	135.00			585.00
41	1	144.00	17.00	112.00		273.00
42	2	270.00	89.00			359.00
43	4	648.00	24.00	1408.00		2,080.00
		$14,562.00	$10,901.00	$9,760.00	$264.00	$35,487.00

*Average Winnipeg prices used in calculations as follows: beaver $18.00; muskrat $1.01; mink $16.00; lynx $32.66.

APPENDIX 13

VALUE OF MOST IMPORTANT FUR SPECIES - NORWAY HOUSE R.T.L. 1968 - 69
(value in $)

		SPECIES*				
R.T.L. #	No. of Trappers	Beaver	Muskrat	Mink	Lynx	Total
1	83	$ 2,860.00	$2,166.90	$ 7,446.00	$ 614.00	$13,086.90
2	7	1,738.00	167.40	510.00		2,415.40
3	4	242.00	144.15	595.00	246.00	1,227.15
4	7	1,804.00	26.35	1,360.00	82.00	3,272.35
5	2	1,100.00	65.10	408.00		1,573.10
6	3	176.00	17.05	493.00		686.05
7	3					
8	3	594.00	12.40	17.00		623.40
9						
10	3	1,034.00	437.10	1,377.00	82.00	2,930.10
11	3	968.00	133.30	714.00	246.00	2,061.13
12	3	1,518.00	139.50	782.00		2,439.50
13	4	616.00	308.45	1,292.00	82.00	2,298.45
14	3	330.00	12.40	459.00	41.00	842.40
15						
16	3	44.00		170.00		214.00
17	3	528.00		272.00		800.00
18	6	154.00	49.60	239.00		442.60
19	2	748.00	71.30	17.00		836.30
20	4	3,036.00	485.15	1,649.00	451.00	5,621.15
21						
22	6	1,914.00	21.70	2,669.00	41.00	4,645.70
23	6	858.00	86.80	544.00	82.00	1,570.80
24	4	1,056.00	82.15	1,173.00	246.00	2,557.15
25	2	110.00	368.90	1,105.00	82.00	1,665.90

		SPECIES*				
R.T.L. #	No. of Trappers	Beaver	Muskrat	Mink	Lynx	Total
26	3	$ 88.00	$	$	$	$ 88.00
27	6	1,342.00	97.65	1,139.00	164.00	2,742.65
28						
29	2	550.00	161.20	289.00		1,000.20
30	3	902.00	240.25	731.00		1,873.25
31	1	66.00	58.90	17.00		141.90
32	4	1,320.00	198.40	1,088.00	123.00	2,729.40
33						
34	2	550.00	34.10	204.00	123.00	911.10
35	3	1,122.00	110.05	272.00	41.00	1,545.05
36	1	22.00		119.00		141.00
37	1	22.00		34.00		56.00
38	1	242.00	40.30			282.30
39						
40	3	814.00	147.25	544.00	41.00	1,546.25
41	3	330.00	18.60	204.00		552.60
42	2	748.00	161.20	612.00		1,521.20
43	2	990.00	24.80	357.00		1,371.80
		$30,536.00	$6,088.40	$28,901.00	$2,787.00	$68,312.25

*Average Winnipeg prices used in calculations as follows: beaver $22.00; muskrat $1.55; mink $17.00; lynx $41.00.

APPENDIX 14

VALUE OF MOST IMPORTANT FUR SPECIES - NORWAY HOUSE R.T.L. 1969 - 70
(value in $)

		SPECIES*				
R.T.L. #	No. of Trappers	Beaver	Muskrat	Mink	Lynx	Total
1	83	$ 2,869.00	$1,895.15	$ 3,224.00	$2,490.00	$10,478.15
2	7	342.00	27.55	481.00	30.00	880.55
3	4	114.00	84.10	221.00	60.00	419.10
4	7	1,102.00	211.70	702.00	660.00	2,675.70
5	2	513.00	2.90	156.00	210.00	881.90
6	3	456.00	5.80	325.00	1,140.00	1,926.80
7	3					
8	3	76.00	27.55			103.55
9						
10	3	285.00	68.15	416.00	30.00	799.15
11	3	342.00	85.55	312.00	150.00	889.55
12	3	1,463.00	120.35	650.00	60.00	2,293.35
13	4	1,026.00	314.65	494.00	360.00	2,194.65
14	3	418.00	8.70	351.00		777.70
15						
16	3			13.00		13.00
17	3	76.00		325.00	90.00	491.00
18	6			91.00	120.00	211.00
19	2					
20	4	1,387.00	474.15	832.00	330.00	3,023.15
21						
22	6	1,121.00	113.10	910.00	390.00	2,534.10
23	6	513.00	95.70	455.00	480.00	1,543.70
24	4	1,653.00	214.60	650.00	1,650.00	4,167.60
25	2	114.00	13.05	546.00	660.00	1,333.05
26	3	19.00	18.85			37.85

APPENDIX [illegible] - Page 2

SPECIES*

R.T.L. #	No. of Trappers	Beaver	Muskrat	Mink	Lynx	Total
27	6	$ 285.00	$ 240.48	$ 104.00	$ 30.00	$ 659.48
28						
29	2	380.00	15.95	325.00		720.95
30	3	855.00	217.50	533.00		1,605.50
31	1	76.00	50.75	39.00	30.00	195.75
32	4	475.00	8.70	520.00	420.00	1,423.70
33						
34	[illegible]					
35	3	[illegible]	2.90			116.90
36	1	19.00	30.45	65.00		114.45
37	1	38.00		65.00		103.00
38	1	190.00				
39						
40	3	361.00	18.85	39.00		418.85
41	3	304.00	46.40	143.00	30.00	523.40
42	2	437.00	76.85	299.00		812.85
43	2	76.00	43.50			119.50
		$17,499.00	$4,533.90	$13,286.00	$9,420.00	$44,738.90

*Average Winnipeg prices used in calculations as follows: beaver $19.00; muskrat $1.45; mink $13.00; lynx $30.00.

APPENDIX 15

VALUE OF MOST IMPORTANT FUR SPECIES - NORWAY HOUSE R.T.L. 1970 - 71

(value in $)

*Average Winnipeg prices used in calculations as follows: beaver $14.09; muskrat $1.57; mink $11.20; lynx $29.50.

	SPECIES*				
R.T.L. #	Beaver	Lynx	Mink	Muskrat	Total Value
1	$2353.03	$3717.00	$1041.60	$3788.41	$10900.04
2	507.24	177.00	89.60	109.90	883.74
3					
4	817.22	383.50	123.20	10.99	1334.91
7/15	211.35		11.20		222.55
10	634.05		11.20	552.64	1197.89
11	239.53	442.65	33.60	78.50	794.28
12	1113.11	295.00	358.40	178.98	1945.49
13	619.96	619.50	168.00	580.90	3933.85
17	169.08				169.08
20	422.70	206.50	44.80	351.68	1025.68
22	859.49	619.50	44.80	141.30	1665.09
23	344.52	472.00	168.00	43.96	1078.48
24	28.18	177.00	112.00		317.18
25	211.35	88.50	78.40	241.78	620.03
27	267.71	88.50	44.80		401.01
30	422.70	29.50	257.60	262.19	971.99
31	99.63	29.50		73.79	201.92
32	972.21	444.00	168.00	287.31	2371.52
35	169.08	118.00		73.79	360.87
36	14.09			47.10	61.19
37	56.36				56.36
38	225.44		11.20	75.36	312.00
39	140.40			64.37	205.27
40	563.60	29.50	22.40	73.79	689.29
41	239.53	29.50		45.53	314.56
42	479.06	59.00	291.20	293.59	1122.85
	$12,230.00	$8,031.00	$3,080.00	$7,375.85	$30,716.85

APPENDIX 16

A TENTATIVE CHECKLIST OF BIRDS BREEDING IN OR NEAR THE OUTLET LAKES AREA

Common loon
Red-necked grebe
Horned grebe
Pied-billed grebe
White pelican
Double-crested cormorant
Great blue heron
American bittern
Canada goose
Mallard
Black duck
Gadwall
Pintail
Green-winged teal
Blue-winged teal
American widgeon
Shoveler
Wood duck
Redhead
Ring-necked duck
Canvasback
Greater scaup
Lesser scaup
Common goldeneye
Bufflehead
White-winged scoter
Ruddy duck
Hooded merganser
Common merganser
Red-breasted merganser
Goshawk
Sharp-shinned hawk
Cooper's hawk
Golden eagle
Bald eagle
Marsh hawk
Osprey
Pigeon hawk
Sparrow hawk
Spruce grouse
Ruffed grouse
Sharp-tailed grouse
Sandhill crane
Virginia rail
Sora
Yellow rail

American coot
Killdeer
Common snipe
Spotted sandpiper
Greater yellowlegs
Lesser yellowlegs
Wilson's phalarope
Herring gull
Ring-billed gull
Franklin's gull
Bonaparte's gull
Common tern
Caspian tern
Black tern
Great horned owl
Hawk owl
Barred owl
Great grey owl
Long-eared owl
Short-eared owl
Boreal owl
Saw-whet owl
Common nighthawk
Belted kingfisher
Yellow-shafted flicker
Pileated woodpecker
Yellow-bellied sapsucker
Hairy woodpecker
Downy woodpecker
Black-backed three-toed woodpecker
Northern three-toed woodpecker
Eastern kingbird
Eastern phoebe
Yellow-bellied flycatcher
Traill's flycatcher
Least flycatcher
Olive-sided flycatcher
Tree swallow
Bank swallow
Barn swallow
Cliff swallow
Grey jay
Blue jay
Black-billed magpie
Common raven
Common crow
Black-capped chickadee
Boreal chickadee
Red-breasted nuthatch
Long-billed marsh wren
Short-billed marsh wren
Robin
Hermit thrush
Swainson's thrush
Golden-crowned kinglet
Ruby-crowned kinglet

Cedar waxwing
Starling
Solitary vireo
Red-eyed vireo
Philadephia vireo
Black-and-white warbler
Tennessee warbler
Orange-crowned warbler
Nashville warbler
Yellow warbler
Magnolia warbler
Cape May warbler
Myrtle warbler
Palm warbler
Ovenbird
Northern waterthrush
Connecticut warbler
Yellowthroat
Wilson's warbler
Canada warbler
American redstart
Red-winged blackbird
Rusty blackbird
Common grackle
Purple finch
Pine grosbeak
Red crossbill
White-winged crossbill
Savannah sparrow
Le Conte's sparrow
Slate-coloured junco
Chipping sparrow
White-throated sparrow
Lincoln's sparrow
Swamp sparrow
Song sparrow

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APPENDIX 18

COMMON AND LATIN NAMES OF PLANTS

Abies balsamea - balsam fir
Acornus sp. - sweet flag
Alnus sp. - alder
Arctostaphylos uva - ursi - bearberry
Betula sp. - birch
Carex sp. - sedge
Ceratophyllum sp. - coontail
Cladonia sp. - reindeer moss
Cornus sp. - dogwood
Drosera sp. - sundew
Equisetum sp. - scouring rush
Juniperus sp. - juniper
Larix laricina - tamarack (larch)
Lemna sp. - duckweed
Myrica sp. - sweet gale
Myriophyllum sp. - milfoil
Picea mariana - black spruce
Picea glauca - white spruce
Pinus banksiana - jack pine
Populus tremuloides - trembling aspen
Populus balsamifera - balsam poplar
Potamogeton sp. - pondweed
Phragmites sp. - flagreed
Salix sp. - willow
Scirpus sp. - bulrush
Sparganium sp. - bur-reed
Typha sp. - cattail

APPENDIX 6 - B

WILDLIFE RESOURCE IMPACT ASSESSMENT - LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS HYDROELECTRIC PROJECTS -

NO. 2 - SOUTHERN INDIAN LAKE

WILDLIFE RESOURCE IMPACT ASSESSMENT
LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS HYDROELECTRIC PROJECTS

NO. 2 - SOUTHERN INDIAN LAKE

by

R. WEBB
F. F. Slaney & Company Limited
Vancouver, British Columbia
February, 1974

for

THE LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD

SPECIAL NOTE

THE CONCLUSIONS AND RECOMMENDATIONS CONTAINED IN THIS APPENDIX ARE THOSE OF THE AUTHOR(S) AND ARE NOT NECESSARILY THE SAME AS THE CONCLUSIONS AND RECOMMENDATIONS OF THE LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD AS EXPRESSED IN THE SUMMARY REPORT AND THE TECHNICAL REPORT.

F.F. SLANEY & COMPANY LIMITED

Telex 04·55287 ▲ 402 West Pender Street ▲ Vancouver 3 Canada ▲ Phone 687·0151

February 15, 1974

File: M 25

Dr. Ian Dickson
Study Director
Lake Winnipeg, Churchill and Nelson Rivers
Study Board
693 Taylor Building
WINNIPEG, Manitoba.

Dear Dr. Dickson:

It is the pleasure of F.F. Slaney and Company Limited to enclose under separate cover the Southern Indian Lake wildlife report, as partial fulfillment of our contract signed June 25, 1973.

We have identified the major wildlife issues associated with Manitoba Hydro's development plans and have proposed feasible ways of reducing the impact of detrimental effects.

Sincerely,

F. F. SLANEY & COMPANY LIMITED

R. Webb

R. Webb,
Project Director.

RW/ldo

VANCOUVER ▲ SEATTLE ▲ EDMONTON ▲ TORONTO

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ABSTRACT

This report identifies and discusses major wildlife resources and potential issues associated with the hydro development project on Southern Indian Lake. Shorelines of the lake are mainly medium-steep bedrock not highly productive of wildlife. Large marshes in the northern end of the lake, however, offer good habitat to several species of birds and mammals.

Data were gathered by field survey, personal communications and literature review.

Shoreline hunting by natives could be affected, as shoreline moose production potential will be lost through flooding. An estimated 35 moose are taken by natives annually, mostly along shorelines during fishing and trapping periods. Sport hunting of moose could conflict with native subsistence hunting. Barren-ground caribou use the northern end of the lake during migration but are not hunted.

Trapping accounts for an average of 4% of the total community income of South Indian Lake. Twenty-one registered traplines will lose some area as a result of flooding. Beaver is the most valuable species to trappers but more muskrat pelts are taken than those of any other species.

The lake is most important to waterfowl as a staging area. Moderate flocks of diving ducks were evident in 1973. Breeding pairs of ducks per mile of shoreline in 1973 were approximately 2 in northern marshes and less elsewhere. Natives kill an estimated 1,000 ducks and geese each year.

Caspian terns were found nesting on the lake; a northerly extension of known breeding range. Ten colonies of gulls and common or Caspian terns were observed. All nesting islands will be inundated. Bald eagles, ospreys, goshawks and several other raptors inhabit the area. Low shorelines with marsh and deciduous growth had highest densities of song birds.

ABSTRACT - Page 2

Several wildlife issues are identified and mitigation possibilities discussed. Most important issues are loss of marsh habitat, loss of trapping potential, loss of gull and tern nesting islands, time required for re-establishment of shorelines and the effect on casual moose hunting opportunities by natives.

SUMMARY

RECOMMENDATIONS

Wildlife issues identified as most significant were:

A. Immediate loss of marsh habitat.

B. Changes in aquatic vegetation and associated fauna as food for staging scaup, goldeneye and mergensers.

C. Time required for re-establishment of acceptable shorelines.

D. Loss of wildlife during flooding.

E. Inundation of gull and tern nesting colonies.

F. Harassment of wildlife.

G. Loss of casual moose hunting opportunity by natives along shorelines.

H. Loss of income from trapping.

I. Potential conflict between sport and native hunting.

Recommended procedures for lessening impact upon wildlife:

1. Regulate water levels to speed re-establishment of shorelines and aquatic vegetation.

2. Clear to speed shoreline development in areas which show potential for becoming productive wildlife habitats.

3. Commence flooding in the last week of June or early July to minimize loss of nesting waterfowl, gulls and terns, and muskrats.

SUMMARY (Page 2)

4. Clear islands to provide alternative nesting sites for gulls and terns.

5. Personnel should be advised to avoid harassment of all wildlife, especially gulls, terns, moose and nesting waterfowl.

6. All campsites and construction areas should be cleared of refuse after removal of the camp and returned to as near natural condition as possible.

7. Garbage from construction camps should be incinerated or transported when feasible.

8. A study of native utilization of ungulates should be initiated to determine numbers of animals shot annually, locations of kills and the economic and nutritional value of this resource.

9. Compensation for trapping losses should be considered. This may be in the form of financial aid or alternate work possibilities.

10. A fur management plan for the area should be developed to encourage trapping and increase harvests on those traplines which are currently under-utilized.

11. Develop a management plan for harvest of moose and caribou. Residents of South Indian Lake community should be allowed to harvest sufficient moose to provide food and hides for their own use.

12. Recreational hunting should be allowed only if populations of moose are deemed sufficient.

13. Residents of construction camps and other visiting personnel should be restricted from hunting in the area, unless they are residents of South Indian Lake community.

SUMMARY (Page 3)

OBJECTIVES

The report identifies wildlife issues associated with hydro development, and assesses effects on wildlife resources, and identifies some mitigation possibilities for Southern Indian Lake.

TERMS OF REFERENCE

F.F. Slaney and Company began work on wildlife resource studies August 15, 1972. A full program of field study began in June, 1973.

THE STUDY AREA

Yearly temperature variations in the Study Area are the most severe of any continental climate. Topography in this typical Canadian Shield area is largely controlled by bedrock, and there have been extensive glacial modifications. Glaciofluvial material may be deposited to considerable depths and peat may be present in depressions. The majority of the Study Area lies in the Boreal Arctic Land Region; the extreme southerly portion is in the Boreal Region.

The Churchill River system, of which Southern Indian Lake is a part, drains 85,000 square miles of Alberta, Saskatchewan and Manitoba. Surface area of Southern Indian Lake is 1,060 square miles. Mean flow at the only outlet, Missi Rapid, is 32,000 c.f.s.

The northern portion of the Study Area lies in the Northwestern Transition Zone, while the southern portion is in the Northern Coniferous Zone. The most predominant forest type is black spruce (open or closed) with prevalent muskeg. Poplar, birch and willow may line shores or invade burned areas.

Six types of shorelines have been defined and approximate miles of each type in the Study Area are given. Miles of marsh shoreline and areas of marsh were also determined.

METHODOLOGY

The method of operation consisted of a program of liaison, study and recommendation. Liaison was carried out with members of the Study Directorate, other Study Board contractors, and Provincial and Federal personnel.

Aerial reconnaissance and field work were undertaken and pertinent information gathered from a number of other sources. Waterfowl surveys were flown in June and September, 1973. Representative shoreline types were surveyed by boat during summer field work. Wildlife observations were related to shoreline and habitat types.

For the purposes of data analysis and impact assessment, the Study Area was divided into six sections. Shoreline information from the Shoreline Impact Study and forest inventory data from the Forest Study Group were used to evaluate wildlife habitats and the probable effects of the development project on wildlife resources.

Manitoba Hydro engineering plans and water level and flow data were interpreted to gain an understanding of the physical effect of the project. Major wildlife involvements were deduced and listed in the report. Possible mitigation procedures were outlined and discussed. Those key issues and related mitigation requirements considered most important were isolated and presented as recommendations.

OBSERVATIONS AND CONCLUSIONS

Most of the area surrounding Southern Indian Lake is low density moose habitat. Potential density is estimated at 0.25 per square mile for the northern portions and slightly higher in the Leaf Rapids-Opachuanau Lake area. Stands of shrub willow and beds of aquatic vegetation will be lost in flooding, resulting in substantial loss of food species.

SUMMARY (Page 5)

Shoreline hunting potential will be diminished. There will be a loss of habitat for 46 - 92 moose, and a loss of a potential annual harvest of 9 - 18 animals. Approximately 35 moose are harvested by the natives of South Indian Lake each year. With increased access to the area, there may be conflict between native and sport hunting.

A segment of the Kaminuriak Population of barren-ground caribou currently migrates across the extreme northern portion of the Study Area. Previously, a portion of this population wintered near South Indian Lake. Numbers of caribou have declined, and wintering areas have changed since numbers of caribou last wintered near the Community in the 1950's. Flooding will have little effect on caribou range or movements. However, some sedge communities will be lost as winter forage.

Beaver pelts provide 55% of the average harvest value to trappers in the Southern Indian Lake Registered Trapline Section. Lynx, mink and muskrat comprise 36% of the value while other species make up the remaining 9%. An average of 82 active trappers have realized an average of $37,000 annually from sale of furs in the last five years. Only 4% of community income is realized from trapping. Twenty-one traplines will lose productive shorelines through flooding. Percent of trapline area flooded varies between 1 and 5 percent.

Beaver will be affected by loss of food species along creeks which will be inundated. A potential annual harvest of 86 beaver may be lost.

Muskrat and mink will be affected by flooding because of their association with aquatic habitats. Lynx may be affected by loss of prey species on productive shorelines.

Sixteen species of waterfowl (ducks, geese and swans) were seen on Southern Indian Lake. Thirteen of these species probably breed in the area. The most common breeding waterfowl were mallard and American widgeon. In 1973, breeding pairs were estimated at 2 per shoreline mile in the best northern marshes. That density held for approximately 250 shoreline miles. Four pairs of Canada geese were seen in June. This species typically nests on smaller lakes and marshes. Productivity of waterfowl was low. The lake is used as a fall staging area particularly by diving ducks. Total waterfowl observed on the lake on September 27 (1973) was 2,519 ducks, geese and swans. Over 90% of these were seen in the northern end of the lake. Hunting pressure comes mostly from natives who may shoot at least 1,000 ducks and geese each year, mainly during peak population periods in spring and fall. Most of the marshes on the north end of the lake will be lost with flooding. Waterfowl production will be reduced until marshes become re-established. In some areas this could take 20-50 years. Value to staging diving ducks may not be changed significantly by flooding.

Three species of gulls and two species of terns nest on Southern Indian Lake. Ten colonies were seen; five of these were inspected. Caspian terns present on the lake were breeding north of their previously known range. All of the gull and tern colonies will be destroyed by flooding. No alternative sites will be available unless clearing is carried out on certain islands near present colonies.

Bald eagles, goshawks and ospreys are present on Southern Indian Lake. Fish-eating raptors will probably not be seriously affected by flooding, but some species that hunt along shorelines will find food diminished after flooding. Small birds that inhabit willow shoreline will be displaced by flooding while forest-upland species will probably not be affected.

SUMMARY (Page 7)

Several mitigation procedures are suggested to lessen the impact of hydro development on the wildlife resources of Southern Indian Lake. These measures are discussed in detail under the following headings:

1. Modification of proposed flooding schedule
2. Determination of optimal water regimes
3. Clearing
4. Avoiding harassment of wildlife
5. Compensation for loss of trapping income
6. Game harvest control
7. General camp practices

ACKNOWLEDGEMENTS

Many agencies and individuals have contributed to this study. As acknowledgement of each individual is not possible, appreciation is collectively expressed for aid and co-operation.

Personnel from several agencies provided valuable information through reports, correspondence and verbal contact. Special mention must be made of assistance received from Dr. K.H. Doan, Rich Goulden, Jack Howard, Tracy Yake, Kent Brace, Wayne Cowan, Joan Kinniburgh, Dick Robertson, and Lester Leung.

The following is a list of government agencies and groups that provided information and reports:

Province of Manitoba

Department of Mines, Resources and Environmental Management (D.M.R.E.M.)

- Mines and Surveys Branch, Forest Inventory
- Water Resources Branch, Planning Division
- Development and Extension Branch
- Research Branch
- Resource Management Division

Department of Northern Affairs

- the preliminary report from the Socio-economic Study Team

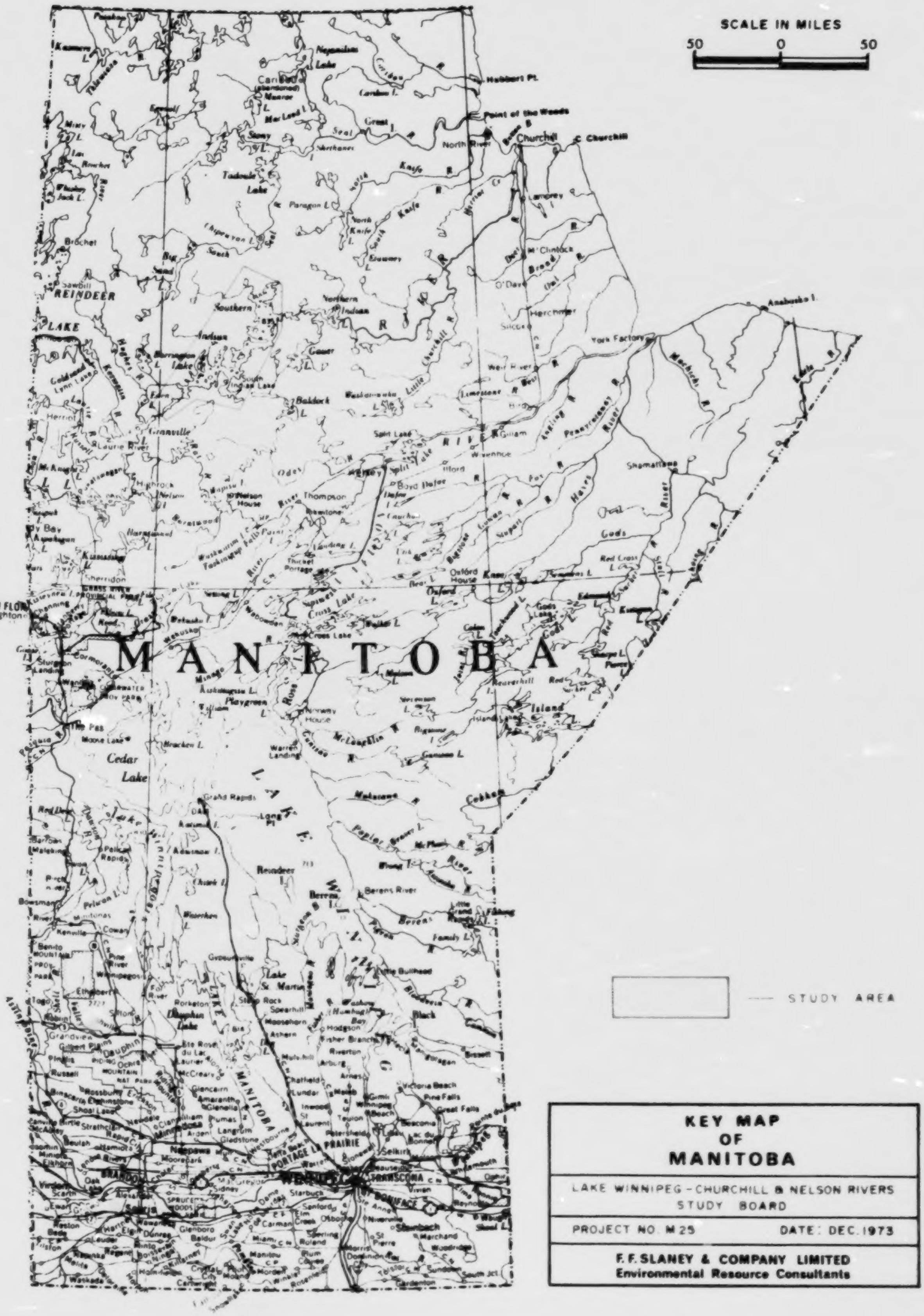
Canadian Wildlife Service

Study Board Staff

The Study Board Staff provided reports, maps and hydro-development plans as they became available, and helped obtain information from other study participants.

Study Participants

Other study participants provided information prior to completion of their final reports. Information from the Physical Impact Study was especially important.


SCALE IN MILES
50 0 50
STUDY AREA
MANITOBA
Churchill
C. Churchill
Hubbart Pt.
Point of the Woods
North River
Nejanilini Lake
Caribou (abandoned)
Seal
Knife R.
Tadoule Lake
Brochet
REINDEER LAKE
Southern Indian Lake
South Indian Lake
Northern Indian
Gauer L.
York Factory
Anabusko L.
Weir River
Limestone
Gillam
Split Lake
Ilford
Shamattawa
Gods
Red Cross L.
Thompson
Nelson House
Thicket Portage
Oxford House
Cross Lake
FLIN FLON
Creighton
Sherridon
Sturgeon Landing
The Pas
Moose Lake
Cedar Lake
Norway House
Warren Landing
Playgreen L.
Island
Grand Rapids
LAKE WINNIPEG
Berens River
Little Grand Rapids
Poplar River
Pelican Rapids
Bowsman
Swan River
Minitonas
Benito
Winnipegosis
Dauphin Lake
Lake St. Martin
LAKE MANITOBA
Dauphin
Gilbert Plains
Grandview
Russell
Hodgson
Fisher Branch
Riverton
Arborg
Gimli
Victoria Beach
Pine Falls
Selkirk
Neepawa
PORTAGE LA PRAIRIE
WINNIPEG
TRANSCONA
BRANDON
Virden
Carman
Steinbach
Morris
Boissevain
Killarney

KEY MAP
OF
MANITOBA

LAKE WINNIPEG – CHURCHILL & NELSON RIVERS
STUDY BOARD

PROJECT NO. M 25 DATE: DEC. 1973

F. F. SLANEY & COMPANY LIMITED
Environmental Resource Consultants

PART 1

RECOMMENDATIONS

Certain wildlife issues require early consideration of mitigative action. They are discussed in the report and are identified in this part by section heading. Recommended procedures for lessening impact are numbered consecutively.

A. IMMEDIATE LOSS OF MARSH HABITAT

B. CHANGES IN AQUATIC VEGETATION AND ASSOCIATED FAUNA AS FOOD FOR STAGING SCAUP, GOLDENEYE AND MERGENSERS

C. TIME REQUIRED FOR RE-ESTABLISHMENT OF ACCEPTABLE SHORELINES

1. Regulate water levels to speed re-establishment of shorelines and aquatic vegetation.

2. Clear to speed shoreline development in areas which show potential for becoming productive wildlife habitat.

D. LOSS OF WILDLIFE DURING FLOODING

3. Commence flooding in the last week of June or early July to minimize loss of nesting waterfowl, gulls and terns; and muskrats.

E. INUNDATION OF GULL AND TERN NESTING COLONIES

4. Clear islands to provide alternative nesting sites for gulls and terns.

F. HARASSMENT OF WILDLIFE

5. Camp personnel should be advised to avoid harassment of all wildlife, especially nestingraptors, gulls, terns, and waterfowl; and moose and caribou.

6. All campsites and construction areas should be cleared of refuse after removal of the camp and returned to as near natural condition as possible.

7. Garbage from construction camps should be incinerated or transported when feasible.

G. LOSS OF CASUAL MOOSE HUNTING OPPORTUNITY BY NATIVES ALONG SHORELINES

8. A study of native utilization of ungulates should be initiated to determine numbers of animals shot annually, locations of kills and the economic and nutritional value of this resource.

H. LOSS OF INCOME FROM TRAPPING

9. Compensation for trapping losses should be considered. This may be in the form of financial aid or alternate work possibilities.

10. A fur management plan for the area should be developed to encourage trapping and increase harvests on those traplines which are currently under-utilized.

I. POTENTIAL CONFLICT BETWEEN SPORT AND NATIVE HUNTING

11. Develop a management plan for harvest of moose and caribou. Residents of South Indian Lake community should be allowed to harvest sufficient moose to provide food and hides for their own use.

12. Recreational hunting should be allowed only if accessible populations of moose are deemed sufficient.

13. Residents of construction camps and other visiting personnel should be restricted from hunting in the area, unless they are residents of South Indian Lake community.

PART 2

OBJECTIVES

The purpose of this report is to identify important aspects of the wildlife resources of the Southern Indian Lake area and to consider mitigation and enhancement possibilities that would benefit those resources.

Specific objectives were to:

1. Identify the nature and extent of probable effects of the development project on wildlife populations, habitats, wildlife resource uses, and wildlife management with emphasis upon critical areas and important considerations.

2. Evaluate the likely effects on wildlife species in relation to their importance to people and to the general ecology of the project area.

3. Determine and assess procedures and programs which would prevent, minimize or mitigate against adverse effects on wildlife populations and habitats and those which would enhance opportunities for wildlife resource use and development.

4. As they are identified and determined feasible, recommend mitigation procedures which would require modification in the engineering, design, construction or scheduling of the development project.

5. Develop guidelines for additional study and adjustment to wildlife resource management programs.

PART 3

TERMS OF REFERENCE

F.F. Slaney & Company were contracted to conduct wildlife resource studies for the Study Board. Studies began in late August, 1972. The initial period was concerned primarily with the Outlet Lakes and a report on wildlife of that area was submitted to the Study Board in March, 1973.

Preliminary data collection and field work had been initiated in August, 1972 for several of the study areas and continued at a low level until March, 1973. It was resumed in June 1973 with a full program of study.

F.F. Slaney & Company were to co-operate with other study participants, obtain and evaluate data, conduct necessary wildlife surveys and define important wildlife resources with regard to socio-economic implications. Recommendations were to be made to the Study Board on questions related to wildlife and wildlife habitat.

The Study Board was to co-ordinate the various study groups and provide data from other study groups as they became available. Information concerning vegetation, soils, forest resources, shorelines and physical and biological impact processes were to be provided to F.F. Slaney & Company by other Study Board contractors.

Field activities were to be co-ordinated through the Study Board field co-ordinator.

PART 4

THE STUDY AREA

The area dealt with in this report is the main body of Southern Indian Lake extending from the southernmost tip of Swan Bay (56°36' N) to the northernmost tip of Moss Lake (57°41'N). The southwestern boundary is Leaf Rapids (56°30' N, 99°55' W) and the eastern and northeastern boundaries are Missi Rapid (98°9' W) and the Waddie River to 98°00' W, respectively (Key Map).

4.1 CLIMATE

The climate of the Southern Indian Lake area has been classified as cold-snowy forest or taiga by Koppen and Geiger (1936). This type represents the extreme in continental climates. Short, cool summers are followed by long, cold winters. Mean annual temperature variation (70-75°F) from January to July is the greatest of any climate. Mean annual temperature is less than 32°F.

Rowe (1959) divides the area at the 57° N. parallel (approximately Sandhill Bay) into the Northern Coniferous Zone (NCZ) in the south and the Northwestern Transition Zone (NTZ) in the north. The frost-free period is 80-90 days in the southern section and 70-80 days in the north. The area is dominated by cold air masses during most of the winter with occasional invasions of warm air from the south. Snow depths are not great, as only 23% of the 17 inches of annual precipitation falls from December 1 to May 1.

4.2 GEOLOGY, TOPOGRAPHY AND LANDFORMS

The area lies within the Churchill province of the Canadian Shield physiographic region. The dominant bedrock is granitic with gneissic and volcanic rock occurring in wide belts. The area was glaciated during the Pleistocene epoch and most current landforms resulted from erosion or deposition by glaciers.

Beke, Veldhuis and Thie (1973) have divided the Study Area into two Land Regions and further into four Land Districts as follows:

LAND REGION	LAND DISTRICTS
1. Boreal	Rat Lake
2. Boreal-Arctic	Kame Hills
	Long Point
	South Bay

That part of the Study Area which lies within the Boreal Region is quite small, extending from Leaf Rapids to the centre of Opachuanau Lake. Only one Land District, Rat Lake, lies within this region. It is characterized by low-moderate relief with bedrock-controlled uplands. The valleys contain deep lacustrine deposits which may be covered by thin to thick organic accumulations. Permafrost is of local extent in the mineral deposits and discontinuous in organic material.

Three Land Districts comprise the Boreal-Arctic land region: Kame Hills, Long Point and South Bay. The Kame Hills District, north of 57°25' N., has low relief peat plains and moderate relief glaciofluvial deposits. There are strongly calcareous glacial till deposits in the northeastern portion. Lacustrine deposits occur beneath peat. Permafrost is discontinuous. The Long Point district, lying approximately between 56°55' N and 57°25' N, has gently undulating to rolling topography controlled by gneissic and granitic bedrock. There are extensive lacustrine deposits underlain by morainal till and numerous bedrock outcroppings. There are peat plains in depressions. Permafrost is discontinuous but is present in most types of material. South Bay district has an overall low relief, bedrock controlled uplands. Lacustrine deposits underlay peat plains and also cover some

Photo 1 - Northern Coniferous Zone between Leaf Rapids and Opachuanau Lake.

Photo 2 - Burn in the Northern Coniferous Zone. Dense growth of deciduous trees invade the area.

Photo 3 - Northwestern Transition Zone forest. Open black spruce with lichen ground cover predominates.

bedrock uplands. Permafrost occurs discontinuously in all materials except esker-kame deposits.

4.3 DRAINAGE PATTERNS

Total drainage area of the Churchill River System is 85,000 square miles, one-quarter of which lies within Manitoba. The westernmost branches begin in Alberta and flow across Saskatchewan, draining the central third of that province. Other rivers flow southward to the Churchill from within 50 miles of the Manitoba-N.W.T. boundary.

The surface of Southern Indian Lake covers approximately 1,060 square miles and the average mean level is 838 feet above sea level. Rivers flowing into Southern Indian Lake include the Churchill, Barrington, Muskwesi and Waddie; the only river draining the lake is the Churchill. Mean flow out of Southern Indian Lake measured at Missi Rapid over 19 years is 32,000 c.f.s.

4.4 VEGETATION

The Study Area lies within the Boreal Forest region (Rowe 1959). Growth is limited in the Northwestern Transition Zone portion of this Region by the smaller number of degree-days (900-1200) compared to 1200-1600 in the south (Flanders, Lamont and Kaye 1973).

4.4.1 Forests

The most prevalent type of forest in the south is closed black spruce (Picea mariana). This species dominates stands formed on thin upland soils and on poorly drained lowlands. Sporadic stands of white spruce (picea glauca) occur on more favourable sites with better drainage, i.e., floodplains and eskers (Photo 1). Muskeg is prevalent, with black spruce the major tree species, and sphagnum mosses (Sphagnum sp.), club mosses (Lycopodium sp.), sedges (Carex sp.) and false Solomon's seal (Smilacina trifolia) forming most of the ground cover. A few stands of jack pine (*Pinus banksiana*) occur on dry sites such as eskers and outcrops. In certain areas where edaphic and climatic factors are favourable, hardwood stands comprised of white birch (*Betula papyrifera*), trembling aspen (*Populus tremuloides*) and balsam poplar (*Populus balsamifera*) develop. Willow (*Salix* sp.) and alder (*Alnus* sp.) usually form the first successional stage on moist lacustrine clays and alluvial deposits on lake and stream banks (Flanders, Lamont and Kaye 1973). Dense growths of deciduous trees are found on burned areas (Photo 2).

In the north, the most common stand is open black spruce with ground cover of lichens (*Cladonia* sp.) and low, prostrate shrubs (Photos 3). On drier sites, the tree canopy is more closed, with denser and higher growth of shrubs. White spruce is found only on floodplains and eskers, while jack pine is present only on dry sites in the southern portion of the zone. Tamarack (*Larix laricina*) occurs occasionally.

Most of the denser stands of spruce and mixed wood occur in a very narrow band along the lake where a moderating influence affords better growth.

4.5 SHORELINES

Shoreline habitat is important to most birds and mammals. The nature of shorelines determines the degree of importance. Long, uninterrupted stretches of steep, exposed bedrock shoreline with little or no fringe of emergent vegetation attract few wildlife species, while wide bands of permanent marshes growing on rich mineral soil generally support a greater number. Similarly, thin peat or muck with good growths of emergent plants such as bulrush (*Scirpus* sp.) cattail (*Typha* sp.) or sedge (*Carex* sp.) and abundant submerged plants, such as pondweeds (*Potamogeton* spp.) attract waterfowl and muskrats. Moose feed on waterlilies (*Nymphaeaceae*) in summer.

Gently sloping beaches with willow and sedge growth provide food and cover for some species of nesting waterfowl, numerous passerine birds, and mammals such as mink and moose.

4.5.1 Shoreline Types

Shoreline types tentatively classified by Newbury (1973) and redefined by the Physical Impact Study (1973) have been used in this report as a partial basis for discussion of wildlife distribution. Lesser types have been combined into larger units, which are briefly described in the following sections (Table 1). General wildlife relationships are outlined in Table 2.

1. Steep Bedrock

This type is characterized by bedrock and/or large, angular boulders rising steeply from the water. Outcrops on the slopes are usually steep and smoothly rounded. Lacustrine clay or till is shallow and appears only in depressions in the profile.

Vegetation is sparse on the bare, water-washed zone. Grasses (Graminae), bluebell (Campanula sp.) and asters (Aster sp.) are in small clumps when present. Willows, white birch, alder, trembling aspen (Populus tremuloides), and black spruce may be present in a deciduous scrub zone. Grasses and feather mosses form the ground cover. A third zone is usually occupied by coniferous types including black spruce, white spruce, and jack pine, with white birch and common juniper (Juniperus communis) occasionally present. Ground cover in this zone usually consists of crustose and foliose lichens, feather mosses, and sphagnum.

TABLE 1

SHORELINE GROUPINGS BY SECTION, SOUTHERN INDIAN LAKE*

	Lake Section (See Map 1)													
	1. Muskwesi-Waddie		2. Missi Rapid		3. Long Point		4. Central Southern Indian		5. South Bay		6. Leaf Rapids		Lake Total	
	miles	%	miles	%	miles	%	miles	%	miles	%	miles	%	miles	%
Steep Bedrock	1	1	24	18	67	29	176	35	15	10	17	14	300	24
Low Bedrock	31	28	36	27	108	47	220	44	38	26	72	59	505	40
Low Bedrock - controlled with or without beach	69	59	60	45	32	14	69	14	79	53	23	19	332	26
Medium-steep in sediment	7	6	1	0.5	8	3	6	1	0	0	2	1	24	2
Low Shoreline	6	5	10	7	17	7	30	6	17	11	9	7	89	7
Fen	1	1	0	0	0	0	5	1	0	0	0	0	6	0.5
Totals	115	100%	131	100%	232	100%	506	100%	149	100%	123	100%	1,256	100%
Shoreline with"marsh" **	31	26	7	5	4	2	59	12	20	13	14	11	132	11

Notes: * Calculated figures based upon unpublished maps, Physical Impact Study, Lake Winnipeg, Churchill & Nelson Rivers Study Board. Mileages are approximate.

** Total "marsh" associated with all shoreline types, usually as a narrow fringe of emergent vegetation.

TABLE 2

SHORELINE TYPES & ASSOCIATED WILDLIFE
SOUTHERN INDIAN LAKE, MANITOBA

SHORELINE TYPE	LAKE SECTIONS* MILES OF SHORELINE AND % WITH MARSHY BORDER 1	2	3	4	5	6	VEGETATION	WILDLIFE USE MAMMALS	BIRDS
STEEP BEDROCK (TYPE II, NEWBURY)	1/0	24/0	67/0	176/6	14/0	16/0	Marsh: bulrush, reeds Outcrop: grasses, asters, blue bell. Scrub zone willow, alder, white birch, trembling aspen Coniferous forests: open or closed black spruce, occas. white spruce	Mink: D,F	Waterfowl: some diving ducks, esp. mergansers F.R.M. Passerines: warblers, sparrows, B.F.M.
LOW BEDROCK (TYPE 13, NEWBURY)	31/0	36/0	108/.5	220/3	38/0	72/.7	Marsh: bulrush, reeds Outcrop: grasses, herbs Scrub zone: willow, alder and juniper. Closed coniferous or deciduous zone: black spruce, trembling aspen, white birch Open or closed coniferous forest: black spruce	Bear:F,T Lynx:F,T Mink:B,D,F Moose:F,T Hares:F,T	Waterfowl: diving ducks, occas. dabblers in marsh F.R.M. Marshbirds: grebes F.M. Larids: gulls and terns on islands B.F.R. Shorebirds: spotted sandpiper B.F.M. Passerines: warblers, sparrows B.F.M. Raptors: eagles R.F.
BEDROCK CONTROLLED (BEACH MAY BE PRESENT) (TYPES 14 & 15, NEWBURY)	69/34	60/2	32/6	69/35	79/21	23/43	Marsh: sedge, bulrush, reeds, pondweeds, water lilies. Outcrop/beach: willow, alder trembling aspen Open or closed coniferous or deciduous forest: black spruce, trembling aspen, balsam poplar, white birch.	Mink:B,D,F,T Lynx:F,T Bear:F,T Moose:F,T Fox,Wolf:F,T Hares:B,F,T	Waterfowl: most dabblers and divers where marsh developed B.F.R.M. Marsh birds: grebes, B.F.R.M. Larids: Caspian terns on beach Shorebirds: occas. use Passerines: flycatchers, warblers, juncos, rusty blackbird Raptors: hawks, owls B.F.
MEDIUM STEEP SLOPE IN SEDIMENTS (TYPES 22 & 23, NEWBURY)	6.5/42	0.5/0	8/0	6.0/0	0/0	1.5/0	Marsh: sedge, bulrush, pondweed Deciduous scrub: willows, balsam poplar Closed mixed: black spruce trembling aspen, white birch Coniferous forest: black spruce, occas. jack pine	Mink:B,F,T Lynx:F,T Beaver:minimal Muskrat:minimal Bear:F,T Moose:F Fox,Wolf:F,T Hares:B,F	Waterfowl: most dabblers and divers where marsh developed B.F.R.M. Marsh birds: grebes B.F.R.M. Shorebirds: favourable to most B.F.R.M. Passerines: chickadees, juncos, warblers, sparrows, B.F.M.
LOW SHORELINE (TYPES 24,26-28 NEWBURY)	6/25	10/5	116/3	30/50	16/1.5	9/33	Marsh: sedge, bulrush, water lilies, pondweeds Deciduous scrub: alders, willows (may be extensive) dogwoods. When muskeg present usually black spruce dominates Backshore, variable: usually black spruce with some deciduous growth. Poor drainage generally	Mink:F,T Lynx:F,T Otter:F Beaver:F Muskrat:B,F Bear:F,T Moose:F Fox,Wolf:F,T Hares:F	Waterfowl: goose, B.F.M. most dabblers and divers B.F.M. Marsh birds: rails, soras, snipe B.F.M. Shorebirds: favourable to many Passerines: thrushes, warblers, swamp sparrow.
FLOATING FEN (TYPE 31, NEWBURY)	1	0	0	5	0	0	Marsh: (no true marsh) sedge Meadow: sedge, occasional willow. Backshore: variable, usually black spruce, tamarack	Little mammal use	Waterfowl: Canada goose, B.F.R. some dabblers and divers B.F. Passerines: swamp sparrow, Traill's flycatcher, yellow warbler.

LEGEND

B=breeding F=feeding R=resting
D=denning M=migrating T=travelling

* See Map 1 for Lake Sections

Approximately 24% of the shoreline of Southern Indian Lake is steep bedrock. Lake Sections 2, 3, and 4, (Map 1) contain most of it, while southern sections have 10-14% and the Muskwesi-Waddie area less than 1% (Table 1).

Value of this shoreline type to wildlife is very limited (Table 2). Passerines may occupy the scrub and conifer zones and mink may use the rocky area. Marsh seldom develops offshore, as the slope is too steep.

2. Low Bedrock

A 10-20 foot wide water-washed zone characterizes this type (Photo 4). Outcrops are usually low, wide and smoothly glaciated. Deposits on the bedrock are thin and drainage is usually good. Permafrost may be present when there is sufficient organic insulation.

Grasses, goldenrod (Solidago sp.), bluebell, fireweed (Epilobium spp.), vetch (Vicia spp.) and aster occur in small clumps on the water-washed shore. A very narrow band of willow, alder and juniper occur next to the exposed shore. The third zone is quite variable and may include black spruce, white spruce, trembling aspen, balsam poplar, white birch and occasionally jack pine. Labrador tea (Ledum groenlandicum), dogwood (Cornus canadensis), highbush cranberry (Viburnum trilobum), sphagnum and feathermosses comprise the understory. This zone usually melds into the typical coniferous forest of the uplands.

Approximately 40% of the shoreline on the lake is low bedrock. Sections 3, 4, and 6 are comprised of 40-60% low bedrock shoreline, while the remaining three sections have 26-27%.

Marsh or beach development is rare with this type of shoreline but occurs occasionally in small bays.

The gentler slope of the shore and wider band of deciduous trees make this type favourable to a greater variety of wildlife. Waterfowl and shorebirds may use the narrow bands of marsh and beach.

3. Low bedrock-controlled or low bedrock-controlled with overburden beach

Slope of this type is less than 20°. The foreshore may be a narrow zone of boulders exposed at the water's edge or a narrow beach of granular material or clay abutting on a clay or till bank (Photos 5 & 6). Overburden is usually thin in the backshore, but may reach several feet in depressions. Where an overburden beach is present, scattered scrub may contain trembling aspen, balsam poplar, willow and alder, with grasses and sedges as ground cover. Backshore vegetation is usually mixed, with trembling aspen, balsam poplar, black spruce and white birch predominating. Alder, dogwood and highbush cranberry may form the understory. Sphagnums are usually present in the ground cover.

Prevalence of this type usually indicates lower overall relief. Lake Sections 1 and 5 have over 50% of their shoreline in this type, and Section 2 has 45%. Section 6 has 19% of this type of shoreline while Sections 3 and 4 have approximately 14%.

Marshes occur adjacent to 42% of the overburden beaches and 10% of the boulder shores. Extensive marshes associated with this type in the Muskwesi-Waddie Section comprise 20% of the total shoreline.

Photo 4 - Low bedrock shoreline. Many passerine species use the mixed-wood forest along the shore.

Photo 5 - Low bedrock-controlled shoreline with overburden beach, South Bay.

Photo 6 - Low bedrock-controlled shoreline with narrow band of willow and sedge, Muskwesi-Waddie Section.

Where marshes occur this shoreline type supports many species of waterfowl, aquatic furbearers and moose. The wide mixed-wood zone supports a variety of small birds and mammals.

4. Medium-steep slope with alluvial or coarse sediments

The foreshore in alluvial material may be initially steeper than that in coarse sediments. Underlying material is either ice-contact or alluvial. Usually, the coarse material is deeper. Beaches in coarse sediments are usually sand or gravel while alluvial beaches are either reworked till or lacustrine sediments (Photo 7).

Vegetation at the shore may be willows, sedges, balsam poplar, grasses and horsetail (Equisetum sp.). On coarse sediments, the forest is usually dominated by black spruce with trembling aspen and paper birch less abundant. Ground vegetation includes Labrador tea, dogwood, bearberry, reindeer moss (Cladonia rangiferina) and feather mosses. On alluvial material, the forest may be a mixed, closed type with balsam poplar, black spruce, trembling aspen, white spruce and white birch. There is a gradual progression into black spruce and tamarack. There may also be an open forest of jack pine with scattered tamarack. Major understory is alder and willow, and the ground cover may be Labrador tea, bluebeard lily (Clintonia borealis), and sphagnums.

This shoreline is found mostly in the north and comprises less than 2% of Southern Indian Lake. Section 1 has the highest percentage (5.5%) of this type.

Photo 7 - Beach in coarse sediments. This shoreline is common in the Muskwesi-Waddie and the Missi Rapid Sections.

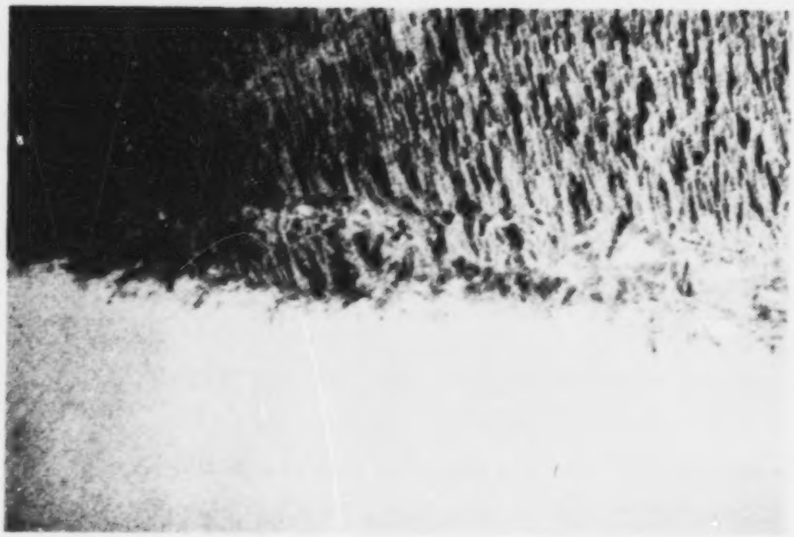


Photo 8 - Treed muskeg. Slumping is prevalent and very few deciduous trees grow close to shore.

Photo 9 - Muskwesi River. Wide bands of submergents, sedges and willows line the banks, providing cover and food for waterfowl and food for moose.

Marsh usually occurs more often on an alluvial shore than on coarse sediments but on Southern Indian Lake, the reverse is true. No marsh occurs on medium-sloped alluvial shoreline, but 14% of the coarse sediment type has marsh extending from it.

Unless marshes are present, wildlife use of this type of shoreline may be confined to passerine species and moose where good browse is available. Nesting waterfowl do not favour sandy beaches, but some birds such as Caspian terns will use them for nesting.

5. Low Shoreline

Several types (24, 26-28) described by Newbury (1973) are included in this group.

Shorelines of this general type may form over alluvial or coarser glacial sediments. Low surrounding relief is common. Stream banks, deltas or shallow embayments are common locations. The foreshore is generally shallow and marshes of significant width are common. Thin, sand beaches may develop when sediment is coarse. If treed muskeg is present, an abrupt beach will occur (Photo 8). Slope of the backshore is very gradual, especially where thick layers of clay or silty clay have been deposited on low-relief bedrock. Usually the backshore has thick deposits of peat and the drainage is poor.

Vegetation in the offshore zone may be wide bands of sedges or more open stands of bulrush and pondweeds. Marshes may extend 1,000 feet from shore. There may be deciduous scrub extending back from the water. Common species are alder, willows, balsam poplar and trembling aspen.

Backshore vegetation may be black spruce muskeg, or if drainage is adequate, mixed wood with tamarack and birch, dogwoods and mosses.

Approximately 7% of Southern Indian Lake has low shoreline but it is scattered throughout. Reflecting the overall low relief of the South Bay Section, this area has the highest percentage of low shoreline (11%). Other sections have only 5-7%.

Where extensive marsh is associated with this type, wildlife value is relatively high. Nesting cover and food are then abundant for waterfowl, marsh and shorebirds. Food and building materials are available to muskrats. Mink can find abundant food and cover. Moose will utilize deciduous browse as well as the water lilies.

6. Fen

In this type thick layers of peat overlay lacustrine clay. The beach is usually water-saturated, black organic mud.

Vegetation is generally lacking in the offshore area as edaphic conditions do not allow establishment of aquatic plants. The shrub community of the backshore ridge consists of willow, bog myrtle (*Myrica gale*) and horsetail. The meadow zone is dominated by sedge with bog myrtle and horsetail.

This type is very rare along Southern Indian Lake. Only sections 1 and 4 possess small areas of fen (ca. 1%).

Use of this type by large birds and mammals is limited. Canada geese will occasionally nest on some of the higher areas.

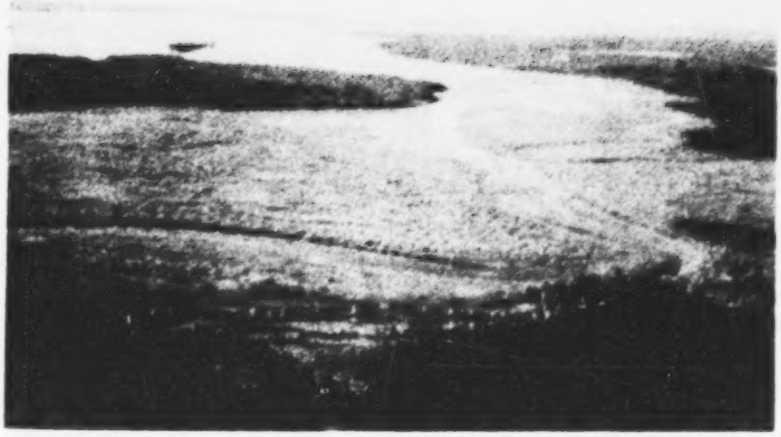


Photo 10 - Sedge meadows and marshes in the Waddie River area provide excellent nesting cover and food for waterfowl.

Photo 11 - Typical small pocket marsh on Southern Indian Lake. Some waterfowl use these areas for feeding and nesting.

Photo 12 - Creek with sedge and willow-alder fringe entering Southern Indian Lake.

4.5.2 Marshes

4.5.2.1 Definition and use of the term "marsh"

A "marsh" is any shallow body of water with stands of rushes or sedges emerging above the water level from a base of mineral or organic soil. Growths of submerged pondweeds are usually but not always interspersed throughout the emergents. Plankton and invertebrates are found associated with the aquatic vegetation. Large marsh areas provide space and a varied habitat with many niches for breeding and foraging birds and mammals.

In this report, the word "marsh" includes the categories of sedge meadow, fringed open water and marsh as described by Adams and Zoltai (1969), and conforms generally with usage by Newbury (1973) and the Physical Impact Study group. It does not include swamp, fen or bog.

4.5.2.2 Ecological Attributes

Productivity of marsh habitat depends basically on its size, depth of water, fertility of soil, water chemistry, and kind and abundance of shoreline cover. Variety, distribution and density of vegetation in marshes are the products of several factors. Climate and geographic location restrict the species which can reach or grow in an area. Distribution of plants can be affected by type of substrate available for rooting, soil and water chemistry, average depth and fluctuation in water levels throughout the year. Density of growth can be directly related to soil and water chemistry and effect of such factors as ice-scouring, wave action and turbidity.

Stagnation at a late stage in succession can restrict the usefulness of a wetland to wildlife. Rejuvenation is an important factor in maintaining high wildlife use. Frequent aeration is necessary in marsh soils to prevent the accumulation of undecomposed organic material. Flooding is also important as it makes available such elements as phosphorus, calcium and magnesium. Besides endogenous recycling, nutrients may also be introduced into an area by surface drainage, wave and current action or rain.

4.5.2.3 Marshes on Southern Indian Lake

The Physical Impact Study group has mapped the extent of "marsh" associated with each type of shoreline and the Forestry Study has given the location and size of three types of wetlands within the floodline: marsh - muskeg, treed muskeg, and willow/alder (Table 3).

Based upon data from both sources and aerial and boat reconnaissance by F.F. Slaney personnel, a map of the north end of Southern Indian Lake has been compiled showing marshes and other wetlands over 3 acres in size (Appendix 5). Due to scale of the map many of the thin fringe marshes could not be displayed.

Largest areas of marsh are found in the northeast and northwest and are associated with the Muskwesi and Waddie Rivers (Photos 9 and 10). In the Muskwesi-Waddie Section of the Lake, over 26% of the shoreline is "marsh" (Table 3). In most cases, these marshes are extensive areas of sedge. Some bulrush might be present and stands of pondweeds are abundant in shallow water.

The Missi Rapid Section has some sedge meadow in small bays and at the ends of creeks (Photo's 11 and 12) but most of its marshes are the fringed open water type occurring in protected areas on overburden beaches. Development of marsh is restricted by water depth. In some reaches, wet areas extend back from shore as treed muskeg.

TABLE 3

COMPARISON OF THE DISTRIBUTION OF WETLAND FOREST INVENTORY TYPES WITHIN THE 850 FOOT CONTOUR INTERVAL AND SHORELINE WITH MARSH , SOUTHERN INDIAN LAKE

	Lake Section						Southern Indian Lake
	1. Muskwesi-Waddie	2. Missi Rapid	3. Long Point	4. Central Southern Indian	5. South Bay	6. Leaf Rapids	
A. Shoreline with marsh* - % mi.	26	5	2	12	13	11	11
B. Total acreage within floodline	22,089	9,613	19,309	44,903	6,462	8,535	110,911
C. Wetlands**							
- marsh muskeg (% of B)	23.7	9.8	6.8	1.4	3.6	4.3	7.9
- treed muskeg (% of B)	52.3	52.4	38.8	16.3	28.3	24.0	31.8
- willow-alder (% of B)	2.0	0.6	.08	.05	-	-	0.5
- Total Wetlands (% of B)	78.0	62.8	45.7	17.8	31.9	28.3	40.2

Notes: * Information from Physical Impact Study, Lake Winnipeg, Churchill & Nelson Rivers Study Board (See Table 1).
** Information from Flanders, Lamont and Kaye (1973).

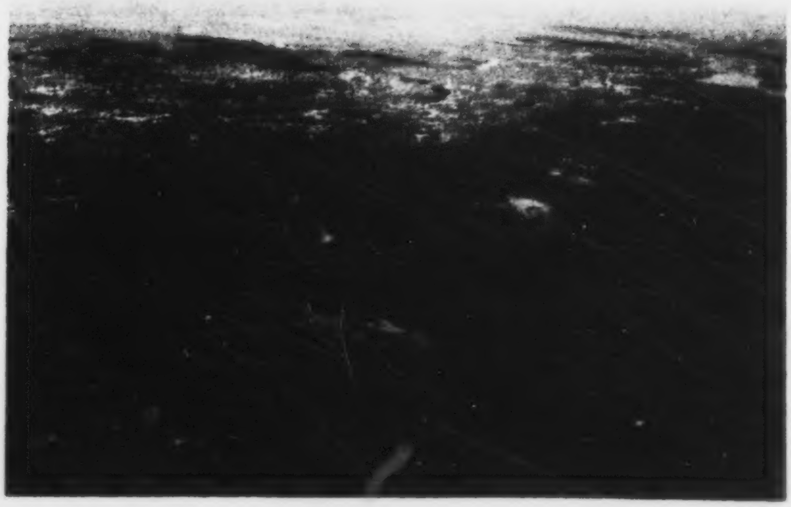
The Long Point Section has the least marsh-type shoreline (1.5%) of any section in Southern Indian Lake. A few fringed open water areas line small protected bays and a few muskeg-type areas extend onto shore.

The three remaining southerly Sections have similar amounts of marsh-type shoreline. Sizes and types of marsh are quite different, however. Marshes in the Opachuanau and Central Southern Indian Sections are mainly the fringe-type, formed along protected shores and in small bays (Photo 13). Marshes in South Bay and Swan Bay are similar to those at the north end, i.e., true marshes and sedge meadows.

A number of similar marshes and small marsh-fringed lakes surround Southern Indian Lake and will be unaffected by the proposed flooding regime (Photo 14).

Photo 13 - Typical fringed open water type developed on a low alluvial shoreline. This shoreline provides a varied habitat for many species of birds and mammals.

Photo 14 - Small lake with marsh fringe west of Southern Indian Lake. Small areas like this will be unaffected by flooding, providing habitat for muskrats and nesting waterfowl.



PART 5

METHODOLOGY

5.1 THE WILDLIFE PROGRAM

The program consisted of liaison, study and recommendation components. The liaison function involved meetings and discussions in Manitoba with the Study Board Directorate and members of the other study groups. Discussions with research, planning and operational personnel of Manitoba's Department of Mines, Resources and Environmental Management (DMREM) and with Canadian Wildlife Service Biologists provided a basis for obtaining data and reports pertaining to the Study Area. Results of the study and recommendations derived from all data sources are included in this report.

5.2 INFORMATION GATHERED

Information pertinent to the Study Area was obtained by various means. Most important was a program of field work from June through September 1973 that consisted of aerial reconnaissance, survey flights, boat and ground work (Appendix 1).

Time and budget limitations necessitated concentrating field activities in areas judged to be of prime significance to important species of wildlife. These judgments were made during aerial reconnaissance of the lake. Representative shorelines were surveyed so that data would be comparable to other areas of the lake not surveyed.

Aerial and boat surveys provided data on waterfowl, gull and tern nesting colonies, moose range and wildlife - shoreline relationships.

Waterfowl surveys were flown along shorelines, attempting to keep within 500 feet of the shore at an altitude of 100 feet and air speed of 90-100 miles per hour. Altitude varied with wind conditions, but did not exceed 300 feet during actual survey time. All surveys were flown in suitable weather conditions (Appendix 2).

Boat surveys were undertaken along shorelines at the north end of the Lake. Surveys followed close to shore so that waterfowl would be flushed from cover. Extensive areas of shoreline were traversed on foot. Several gull and tern nesting colonies were visited. Observations were made on nest locations, nesting material, numbers of nests and eggs, and the general physical nature of the islands. Moose habitat utilization was noted.

The Study Board Staff provided maps, photo mosaics, engineering plans and schedules, floodline information, reports by other study participants and assisted in obtaining water level and flow information from Manitoba Hydro. Study participants provided unpublished data and maps and general project information through informal discussions. Shoreline information was provided by the Physical Impact Study in the form of draft maps. The Fisheries and Limnology Study group provided data from productivity studies in the Study Area. Forest inventory data and maps for the affected area were provided by DMREM's Forest Inventory Branch.

Canadian Wildlife Service personnel provided unpublished waterfowl staging survey data. Personnel from DMREM in Winnipeg supplied reports, big game and waterfowl harvest statistics, fur harvest data and maps of Registered Trapline Sections. Interviews with government biologists and conservation officers provided information on the wildlife resources and their utilization in the Study Area. Fur harvest statistics were obtained from the DMREM regional office at The Pas.

5.3 REPORT DEVELOPMENT

Southern Indian Lake was arbitrarily divided into six Sections. Divisions were based on general features of shorelines and habitat. Wherever possible, data and interpretations are presented with respect to Lake Sections and their associated major shoreline characteristics (Map 1).

Shoreline information provided by the Physical Impact Study follows the classification of Newbury (1973). From these data, miles of shoreline types were calculated for each Lake Section.

Information on vegetation types within the floodline was derived from the Forest Resources report (Flanders, Lamont and Kaye 1973) and forest inventory data supplied by the Forest Inventory Branch of DMREM.

Information from productivity studies (Cleough 1973) was used in the development of the impact section of this report.

Fur harvest statistics were recalculated where necessary.

Previous authors (Welch et al 1966, Goulden et al 1968 and Underwood McLellan 1970) discussed the impact of development on wildlife resources in the area. Their reports were reviewed.

Manitoba Hydro engineering plans and water level and flow data were interpreted in an attempt to understand the physical effects of the project. Insofar as it was possible, physical effects were determined and evaluated (App. 14). Potential wildlife effects of a significant nature were identified. For each of the main wildlife involvements, possible mitigation procedures were considered. Those key issues and related mitigation requirements are presented as recommendations. A preliminary listing of key issues was submitted to the Study Board in October, 1973.

PART 6

OBSERVATIONS AND CONCLUSIONS

6.1 CURRENT STATUS OF IMPORTANT WILDLIFE RESOURCES

This Part includes sections on the current status of important wildlife species or groups of species, potential effects of flooding on those animals and their habitat, and a listing of possible prevention or mitigation procedures.

6.1.1 Moose

The limited information available on moose (Alces alces) in the Southern Indian Lake area suggests that environmental conditions are severe and populations are low.

6.1.1.1 Habitat

Riparian willow growth and young deciduous and mixed-wood stands on burned areas are important in distribution of this large herbivore (Bryant 1953 and Goulden et al 1973). Early successional stages after fire offer palatable and nutritive browse species (Cowan et al. 1950). Aquatic plants such as water lily (Nuphar sp.) and pondweed (Potamogeton spp.) are eaten when available, but are not of major significance in distribution of moose (Bryant op. cit.). Good winter and summer habitat is usually a mixture of areas with plentiful browse and mature forest (Cowan et al 1950).

The best habitat in the Study Area is found in Sections 1, 5, and 6. Relief in Sections 1 and 5 is generally low and there is extensive willow growth and marsh development. There are several burned areas in Section 5. Section 6 from Leaf Rapids to Opachuanau Lake has steeper shorelines, but there are numerous pocket marshes and a large burned area with new deciduous growth.

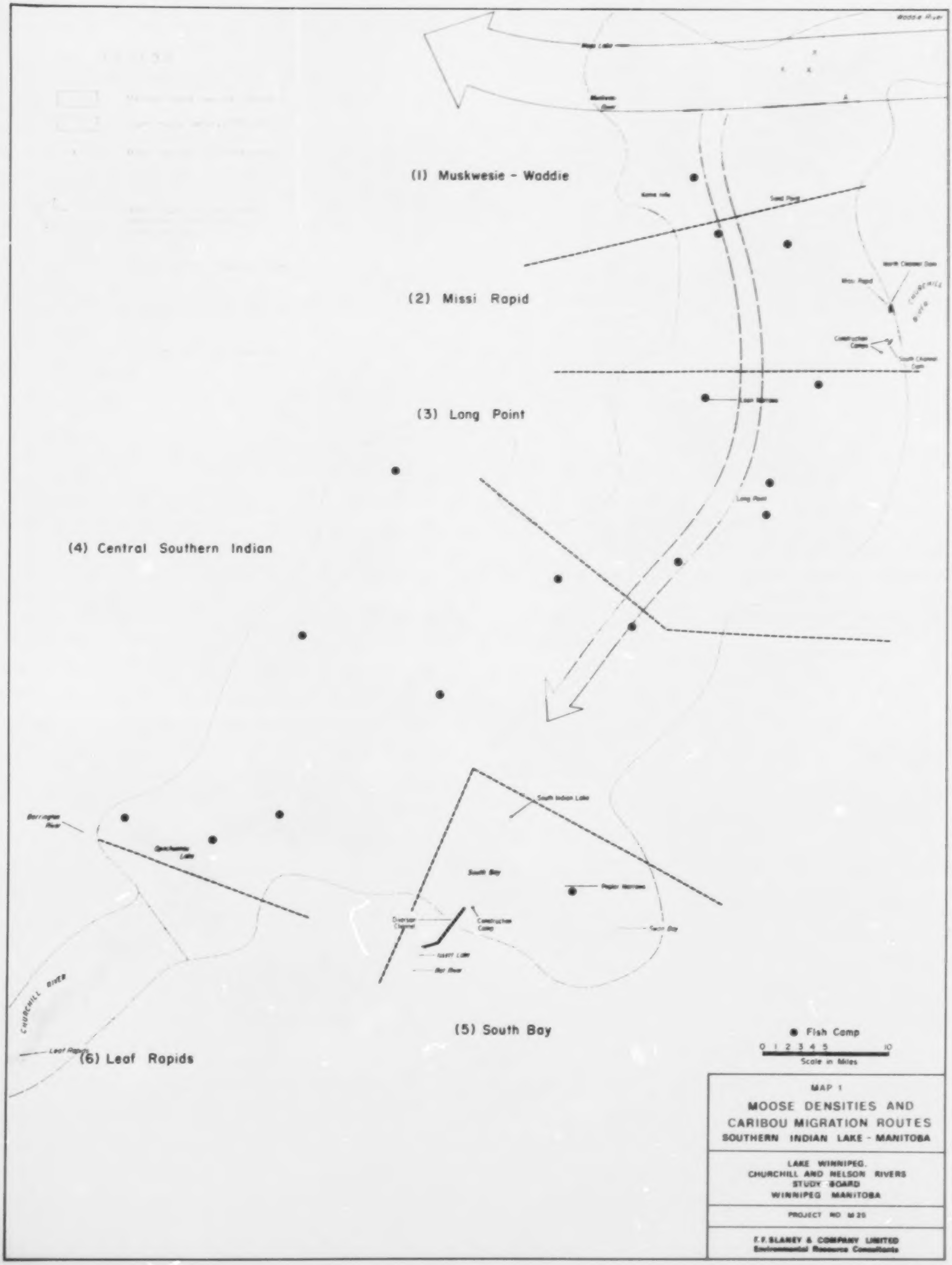
6.1.1.2 Distribution and Abundance

All sightings of moose during summer aerial surveys were in the north part of the Lake (Map 1). Animals were along shorelines, either in stands of willow or feeding in beds of submerged and floating aquatic plants.

No official rating of the Southern Indian Lake area has been done under the Canada Land Inventory system. However, most of the lake area appears to fall into Classes 4 or 5 of the C.L.I. capability rating scheme. Those classes describe habitat typical of the Precambrian Shield with moderate (4) and moderately severe (5) limitations to moose production. Exposed bedrock, poor soils and limited variety of land form appear to restrict ungulate production. Potential carrying capacities of Classes 4 and 5 in Manitoba are 0.4-0.6 and 0.2-0.3 moose per square mile, respectively (Goulden et al. 1973).

Goulden et al (1968) estimated the potential carrying capacity of the Southern Indian Lake area to be 0.5 moose per square mile. Howard (1970a) made a generalized estimate of a density of 0.25 for northern Manitoba, including the Study Area. Average unadjusted winter densities from aerial surveys in four areas south of Southern Indian Lake were 0.29 moose per square mile (Table 4). Adjusting conservatively for visibility factors, (two times actual observations), densities in those areas may average 0.6 moose per square mile.

Although moose densities in local areas of winter concentration could be higher, a winter density of between 0.25 and 0.5 moose per square mile for the Southern Indian Lake flood area appears to be a reasonable estimate.


Waddie River
(1) Muskwesie - Waddie
(2) Missi Rapid
Missi Rapid
North Channel Dam
Churchill River
Construction Camps
South Channel Dam
(3) Long Point
Long Point
(4) Central Southern Indian
South Indian Lake
Barrington River
South Bay
Diversion Channel
Construction Camp
Churchill River
Leaf Rapids
(5) South Bay
(6) Leaf Rapids
● Fish Camp
0 1 2 3 4 5 10
Scale in Miles

MAP 1

MOOSE DENSITIES AND
CARIBOU MIGRATION ROUTES
SOUTHERN INDIAN LAKE - MANITOBA

LAKE WINNIPEG,
CHURCHILL AND NELSON RIVERS
STUDY BOARD
WINNIPEG MANITOBA

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TABLE 4

WINTER MOOSE DENSITIES IN NORTHERN MANITOBA

(Moose per square mile - unadjusted aerial transect data)*

	YEAR											
Area	'61	'62	'63	'64	'65	'66	'67	'68	'69	'70	'71	'72
Lynn Lake	.45	.45	.49	.43	.14	.18	.18	.18				
Thompson							.24	.18				
Granville Lake - Rat River									.20			
Outlet Lakes												.30

*Respective sources: DMREM; Underwood McLellan (1970); and F.F. Slaney (1973).

6.1.1.3 Moose Hunting

Conservation Officers suggest that moose are harvested in the Study Area mainly by natives from South Indian Lake to provide meat and hides.

Moose are shot when available along trails and waterways throughout summer, fall and winter. A significant portion of the harvest is apparently taken by fishermen along the shore during summer. Fall hunting parties and trappers in winter take the remainder.

Annual harvest by South Indian Lake residents has been estimated at 15 moose by the local Conservation Officer (George Paylor pers. comm). From interviews in the community, Collinson et al (1973) estimated the annual kill to be 50 moose per year. Fisheries personnel working in the area in 1972 and 1973 have suggested that the harvest is approximately 35 animals per year. Previous studies by Goulden et al (1968), Welch and Stewart (1966) and Underwood McLellan (1970) gave no harvest estimates for the Study Area.

Favoured hunting areas in the past have been around Uhlman Lake, Poplar Narrows and the Waddie and Muskwesi River areas. The latter two areas have apparently provided a good harvest in past years, though somewhat sporadic.

Sport hunting is at present restricted by limited transportation. The area is accessible by boat from Leaf Rapids but long distances discourage recreational hunters from going beyond Opachuanau Lake.

The Study Area lies within Provincial Game Hunting Area Number 1. Moose hunter questionnaire results from DMREM for the 1972-73 hunting season indicate an estimated sport hunter harvest of 73 (± 84%) moose for Game Hunting Area Number 1. Area Number 1 provided 2.7 per cent of the provincial kill. Study Area harvest totals would therefore be a small fraction of the provincial harvest figure.

6.1.2 Barren-ground Caribou

6.1.2.1 Migration Patterns and Habitat Preferences

Lichens and other plants in the Transition Zone Forest provide suitable winter forage for migrating caribou (Photo 3). Kelsall (1968) reports that lichens comprise slightly less than half of the winter diet of caribou with the remainder consisting of perennial plants and shrubs (Vaccinium spp., Carex spp., Ledum groenlandicum, and Salix spp.). These plants are found in the Muskwesi-Waddie, Missi Rapid, and Long Point Sections of the Study Area, all in the Northwestern Transition Zone. These lake sections constitute potential caribou winter range of moderate quality while southern sections of Southern Indian Lake are less suitable. None of the area has been classified by the Canada Land Inventory.

Detailed studies of barren-ground caribou (Rangifer tarandus) have not been undertaken in the Southern Indian Lake area. However, Parker (1972) states that northern sections are occasionally used as a migration route to wintering grounds by animals of the Kaminuriak Population. One segment of this population migrates from summer range in the Northwest Territories by the northern portion of Southern Indian Lake to wintering grounds north-east of Reindeer Lake (Map 1). The migration intermittently takes place at Southern Reindeer Lake from December to January with caribou not remaining long, except for small herds of adult males. Caribou were last seen approximately 8 miles north of Moss Lake in the winter of 1971-72 (George Paylor pers. comm.).

In past decades, caribou migrated much further south into Manitoba (Howard 1970b). Herds previously moved in winter to the South Indian Lake community (George Paylor pers. comm.). Large numbers have not been recorded wintering near the community since the early 1950's (Goulden et al. 1968). The last reported sightings were in 1966.

Changes in migration patterns of barren-ground caribou can be attributed to declining population levels since the 1950's (Parker 1972). Winter ranges have correspondingly decreased. Should populations increase in the future, barren-ground caribou could be expected to resume their former movement pattern.

6.1.2.2 Caribou Hunting

Utilization of caribou by natives in the Study Area has been opportunistic, and largely limited to years when caribou migrated to wintering grounds near South Indian Lake community. Harvests in such years provided meat and hides from many animals. Parker (1972) states that bands of adult male caribou may migrate to areas south of the main wintering grounds. These bands represent a potential harvest to natives not currently realized. Sport hunting of caribou is presently not permitted.

6.1.3 Furbearers

In terms of both economic value and numbers, the major species trapped in the Southern Indian Lake area are beaver (Castor canadensis), lynx (Lynx canadensis), mink (Mustela vison) and muskrat (Ondatra zibethicus).

6.1.3.1 Distribution and Habitat Relationships

Beaver

Beaver populations are associated with willow, aspen, alder, poplar or birch along edges of creeks and marshes and some lake shorelines adjacent to burned areas. Principal sources of food and building material in northern Manitoba are poplar (Populus spp.) and willow. Aquatic plants, particularly rhizomes of water lilies (Nuphar spp.), form a significant portion of the beaver's diet (Nash 1951).

Shoreline type has little direct relation to the distribution of beaver in the Study Area. Beaver primarily inhabit small creeks and channels leading into the lake (Photo 12). Lodges were observed irregularly on streams. Beaver abundance is low in sections north of Long Point due to low abundance of suitable food trees (van Zyll de Jong 1970). Poplar is at the northern extreme of its range in northern lake sections.

Lynx

Although lynx are found throughout the Study Area, abundance is highest in southern sections (van Zyll de Jong 1970). This is reflected in trapper returns (Appendices 9-13).

Lynx require a large land area for their predatory existence. There is little dependence on lake shorelines as all forest types are utilized.

Mink

Mink are semi-aquatic and favour low bedrock, medium-steep sediment and low shorelines which have good deciduous growth. These types are prevalent throughout the Study Area.

Food habits of mink change throughout the year. Mammals are the most important prey, especially muskrats during winter. Other prey includes shellfish, insects and birds (Urban 1969).

Muskrat

In terms of number of pelts, muskrats (Ondatra zibethicus) are the most trapped species in the Study Area (Appendices 9-13).

Muskrats prefer a reed-swamp (McLeod et al 1951) or marshy type of habitat, providing a suitable supply of rooted aquatic vegetation. Muskrat houses, feeding platforms and push-ups are constructed in marshes (Schmitke 1971).

Because of accessibility under the ice, the most important food species during the winter period are scouring rush (Equisetum sp.), bulrush (Scirpus sp.) and pondweed (Potamogeton spp.). During the summer, important species are scouring rush and bulrush (McLeod et al 1951). These aquatics are found in marshes and along marshy shorelines of Southern Indian Lake.

Distribution of muskrats is directly related to marsh habitat (Photos 9 and 10). Marsh shorelines are frequent only in Section 1, which provides the largest expanse of suitable muskrat habitat in the Study Area. Smaller areas of marsh (Photo 11) found in Section 5 are also good habitat. Small pocket marshes where creeks enter the Lake are also used.

Other Furbearers

Other species trapped in the Southern Indian Lake area include otter (Lutra canadensis), fox (Vulpes spp.), pine marten (Martes americana), red squirrel (Tamiasciurus hudsonicus), wolf (Canis lupis) and wolverine (Gulo luscus). All of these account for only 9% of the total annual returns. Most furbearers in the group are land based, but may be indirectly dependent on shorelines.

Although black bears (Ursus americanus americanus) are considered to be of medium density in the Southern Indian Lake area (DMREM 1961) this species is currently only lightly utilized. Only four black bear pelts have been recorded over the 1967-68 to 1971-72 period. Goulden et al (1968) considered black bears as not being commercially utilized, except for the occasional pelt. Fur harvest data probably do not reflect the actual numbers of bears shot. One sighting of a black bear was made during field work in 1973. The animal was seen near the banks of the Muskwesi River in July.

6.1.3.2 Fur Production

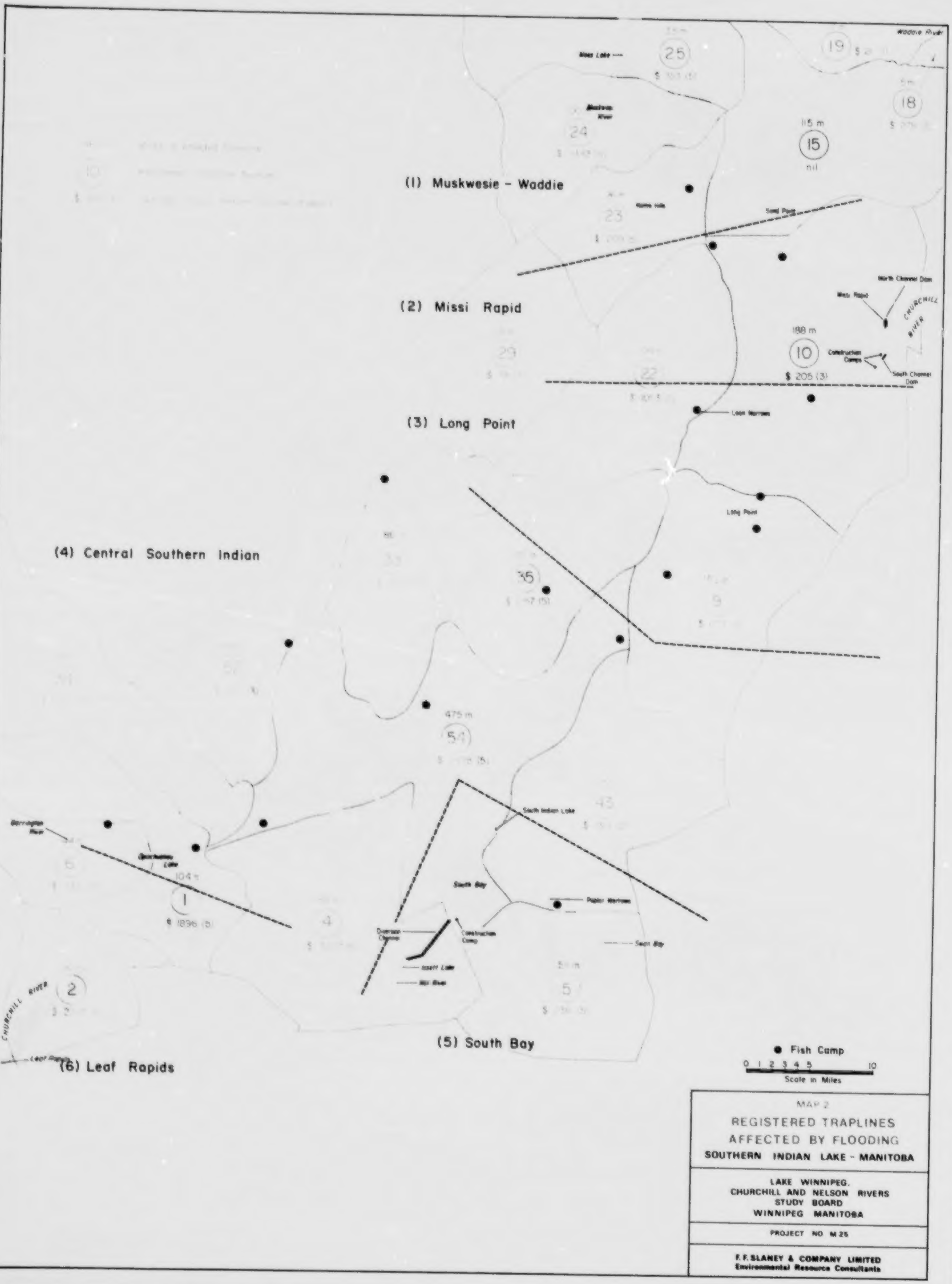
Furbearers in northern Manitoba are harvested under a registered trapline (RTL) system established in the 1940's. RTL's are assigned to individuals who often retain helpers during the trapping season.

Fur harvest data are collected by the Manitoba Government. Fur dealers in the Province annually submit a record of all furs purchased. This record goes to local Conservation Officers, then to regional headquarters (The Pas for the Southern Indian Lake Registered Trapline Section) and Winnipeg.

The trapping season begins around Southern Indian Lake in late October and continues until May. Trapping of individual species is mostly in periods of the year when pelts are prime, e.g., muskrats, spring and fall; mink, early winter; lynx, mid-winter.

Animals are pelted both on the trapline and at the trapper's home. All subsequent pelt preparation after skinning is usually done by the trapper at home. Travel from communities to traplines is time consuming, and costly. RTL's near communities are utilized to a greater extent than remote RTL's, such as those in the Muskwesi-Waddie area. Fish camps and cabins are used as bases by those trappers working remote traplines.

A community trapline near South Indian Lake is used by residents who do not have their own trapline. This trapline also serves a recreational function for the community. Recently, trapper organizations have been formed to facilitate better fur harvests and increase liaison with government departments.


(1) Muskwesie - Waddie
(2) Missi Rapid
(3) Long Point
(4) Central Southern Indian
(5) South Bay
(6) Leaf Rapids
Waddie River
19
25
Moss Lake
18
24
Muskwesie River
115 m
15
nil
23
Home Hill
Sand Point
North Channel Dam
Missi Rapid
CHURCHILL RIVER
188 m
10
$ 205 (3)
Construction Camps
South Channel Dam
29
22
Loon Narrows
Long Point
35
$ 147 (5)
9
475 m
54
South Indian Lake
43
Barrington River
Opachuanau Lake
104 m
1
$ 1896 (5)
6
4
South Bay
Poplar Narrows
Diversion Channel
Construction Camp
Swan Bay
Issett Lake
Rat River
5
2
CHURCHILL RIVER
Leaf Rapids
● Fish Camp
0 1 2 3 4 5 10
Scale in Miles

MAP 2

REGISTERED TRAPLINES
AFFECTED BY FLOODING
SOUTHERN INDIAN LAKE - MANITOBA

LAKE WINNIPEG,
CHURCHILL AND NELSON RIVERS
STUDY BOARD
WINNIPEG MANITOBA

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Value of the fur harvest in South Indian Lake declined from $46,010 in 1968-69 to $29,098 in 1971-72 (Table 5). It is expected that higher fur prices in the 1972-73 season (no harvest figures available) will reverse this trend. There is some correlation between the number of active trappers and the total annual return.

The average annual value of fur sales to the community during the 1967-68 to 1971-72 period was $37,242. The fur resource represents approximately 4% of community income (2% from fur sales and 2% as income-in-kind, estimated at $10,000 by Collinson et al. 1973). Average net value of fur sales, after deducting operating costs, equals 60% of $37,242 or $22,345.

Beaver provide 55% of the annual harvest value, followed by lynx (14%), mink (13%) and muskrat (9%). Other species add the remaining 9% (Table 6).

Traplines in the southern portion of the study area show the highest returns. This is probably due to species availability, proximity to the community, and better habitat.

6.1.3.3 Potential Fur Production

Fur production is influenced to a large degree by world market trends. As present fur prices are higher than in the past few years, fur returns should increase correspondingly in the 1972-73 season.

Government programs are being developed which will increase utilization of the resource through more intensive resource management practices and trapper education.

Most furbearers in the Southern Indian Lake area appear to be underutilized at present, especially in remote RTL's. Travel difficulties and lack of trapper motivation depress harvests.

TABLE 5

TRENDS IN FUR HARVEST VALUES

SOUTHERN INDIAN LAKE REGISTERED TRAPLINE SECTION, 1967-68 TO 1971-72

YEAR	NO. OF ACTIVE* TRAPLINES	NO. OF ACTIVE** TRAPPERS	NO. OF PELTS HARVESTED	VALUE*** (ALL SPECIES)	AVERAGE RETURN PER ACTIVE TRAPLINE
1967-68	31	64	5,865	$40,997	$1,322
1968-69	38	90	4,559	46,010	1,210
1969-70	42	87	3,493	37,339	889
1970-71	43	91	3,954	32,770	762
1971-72	39	77	2,412	29,098	746
AVERAGE	38	82	4,056	$37,242	$1,114

Source: DMREM fur dealer returns, The Pas.

* Pelts harvested on traplines

** Minimum of one pelt harvested

*** Calculated using prices paid at current year auction sales (R. Burns pers. comm.)

TABLE 6

TRENDS IN SPECIES FUR HARVEST VALUES, SOUTHERN INDIAN LAKE REGISTERED TRAPLINE SECTION, 1967-68 TO 1971-72

YEAR		SPECIES					
		BEAVER	MUSKRAT	MINK	LYNX	OTHERS	TOTAL
1967-68		$24,498	$3,993	$ 7,904	$1,829	$2,612	$40,997
1968-69		26,114	4,174	10,030	3,649	2,993	46,010
1969-70		19,190	2,726	4,537	7,620	3,106	37,339
1970-71		20,064	3,392	2,251	4,956	2,050	32,770
1971-72		13,580	2,753	2,106	7,311	3,328	29,098
AVERAGE	%	55	9	13	14	9	100

Source: DMREM fur dealer returns, The Pas.

6.1.4 Birds

The avifauna of the Southern Indian Lake area is typical of that found in the western subarctic Shield Region except for the occurrence of several southern wetland species at the northern extremities of their range and two species of "larids" breeding north of their recorded range. A tentative checklist of birds breeding in the area is given in Appendix 6.

6.1.4.1 Waterfowl

Little specific information is known about the migratory habits of waterfowl (ducks, geese and swans) that use Southern Indian Lake for breeding and/or staging, since no local banding has been carried out. Some ducks and swans are probably Atlantic Flyway birds while other ducks and some of the geese follow the Mississippi Flyway. Most of the "Canada's" and some of the other species contribute to the Central Flyway.

Canada geese that nest in the Southern Indian Lake area are largely of the Western Prairie Population of Branta canadensis interior (Raveling pers. comm.). They do not form a large part of the Manitoba flight. Geese from Mountain Rapids in the Churchill River to Southern Indian Lake comprise 5 - 10% of the Eastern Prairie Population. Birds from this population winter at Swan Lake Refuge in Missouri. Little is known of the Western Prairie Population, but there have been band returns from Dakota and Texas (Raveling pers. comm.).

Southern Indian Lake is probably important to more species as a staging rather than breeding area. Weir et al (1960) indicate that breeding ducks are scattered in occurrence at moderate to low levels throughout most of northern Manitoba. Raveling (1970 and pers. comm.) suggests that breeding densities of Canada geese are moderate in the northeast corner (around the Churchill River) and low in other areas of the lake.

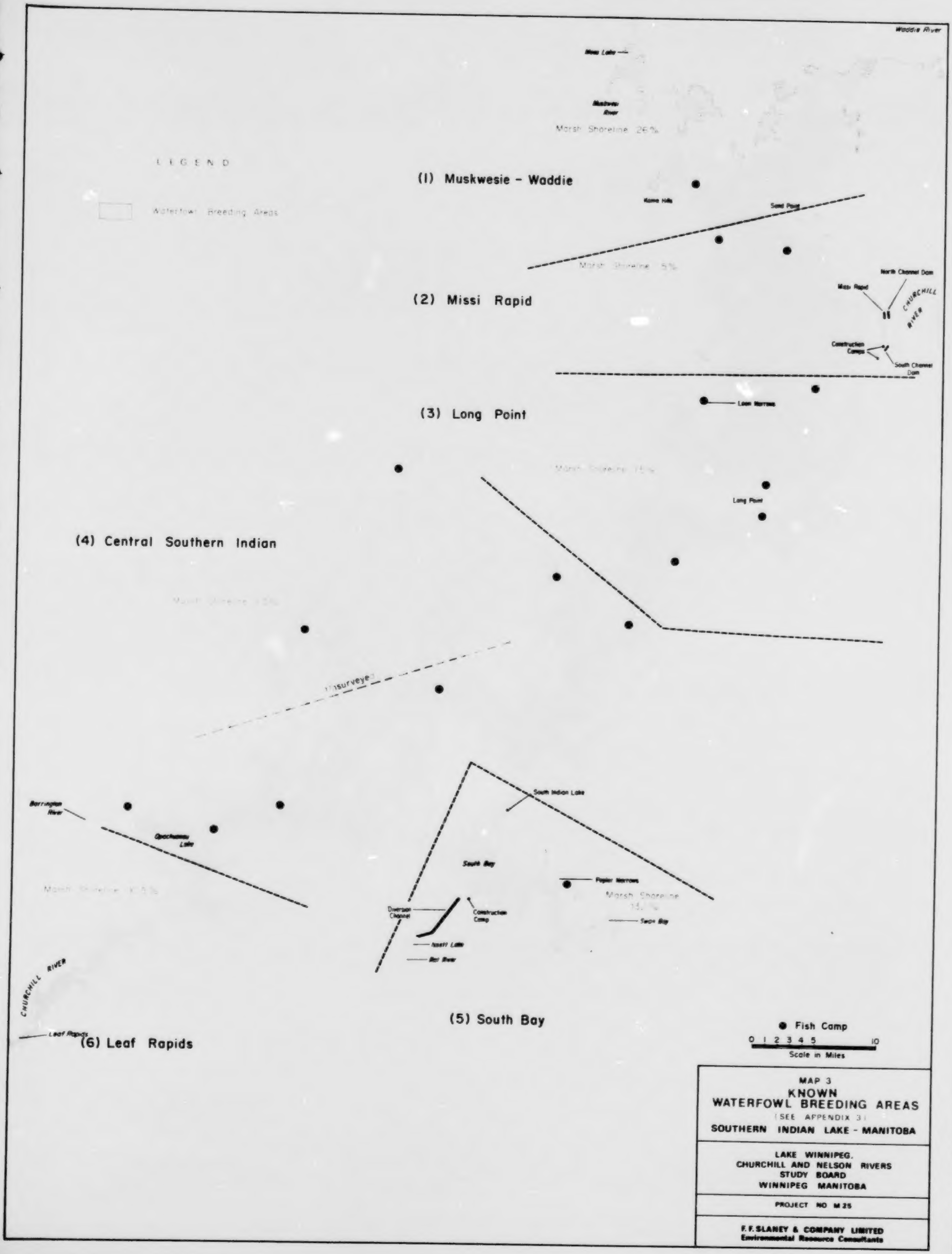
Breeding surveys by plane and boat in June, 1973, revealed low numbers of breeding pairs per mile of shoreline. Flights in September, 1973, by F.F. Slaney personnel and in October, 1968 by the Canadian Wildlife Service, located certain areas on the lake used by moderate numbers of staging waterfowl.

Production

Sixteen species of waterfowl were observed on Southern Indian Lake during 1973. From observations of nests, females with young, or behaviour (territorial lone males or pairs), there was evidence that 13 species bred on the lake or in close proximity (Appendix 6). The Muskwesi-Waddie and Missi Rapid Sections were the most important areas (Map 3).

Highest occurrence of breeding pairs (.73/mile shoreline) was found in Section 2 during a boat reconnaissance around Missi Rapid (Table 7). The most common breeders in this section were American widgeon (Mareca americana) and common loon (Gavia immer). The fewest breeding pairs seen during the aerial survey were in Section 4. Mallards (Anas platyrhynchos) and American widgeon were the most frequent nesters of the dabbling species while lesser scaup (Aythya affinis) and common goldeneye (Bucephala clangula) were the most common breeders among diving ducks. Mergansers (Mergus spp.) were the most numerous ducks observed during the aerial survey, June 17. These birds were easily visible along the rocky shores of the Missi Rapid section. Only one pair of green-winged teal (Anas carolinensis) was observed during the surveys. No blue-winged teal (Anas discors) were seen on Southern Indian Lake.

Four pairs of Canada geese (.08/mile shoreline) were observed during the flight in Section 1. Pairs were also observed in Sections 3 and 4, but none were seen in Section 2. A pair of geese with 3 goslings were observed above Missi Rapid on June 25.


Waddie River
Mosa Lake
Muskwesi River
Marsh Shoreline 26%
LEGEND
Waterfowl Breeding Areas
(1) Muskwesie - Waddie
Kame Hills
Sand Point
Marsh Shoreline 5%
(2) Missi Rapid
North Channel Dam
Missi Rapid
CHURCHILL RIVER
Construction Camps
South Channel Dam
Loon Narrows
(3) Long Point
Marsh Shoreline 15%
Long Point
(4) Central Southern Indian
Marsh Shoreline 15%
Unsurveyed
Barrington River
Opachuanau Lake
Marsh Shoreline 10.5%
South Indian Lake
South Bay
Poplar Narrows
Marsh Shoreline 13.1%
Swan Bay
Diversion Channel
Construction Camp
Issett Lake
Rat River
CHURCHILL RIVER
Leaf Rapids
(6) Leaf Rapids
(5) South Bay
● Fish Camp
0 1 2 3 4 5 10
Scale in Miles

MAP 3

KNOWN
WATERFOWL BREEDING AREAS
(SEE APPENDIX 3)
SOUTHERN INDIAN LAKE - MANITOBA

LAKE WINNIPEG,
CHURCHILL AND NELSON RIVERS
STUDY BOARD
WINNIPEG MANITOBA

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F. F. SLANEY & COMPANY LIMITED
Environmental Resource Consultants

On June 23, a female mallard with a newly hatched brood (Table 14), was observed above Missi Rapid. Assuming the normal incubation period (26 days), this hen probably initiated her nest in mid-May. As the spring was above average in temperature and snow disappeared earlier than usual (Brazda and Gimby 1973), most successful mallards were probably well into their third week of incubation by mid-June (mallards are among the earliest nesting dabblers). During the latter part of incubation, if the nest has not been destroyed or abandoned, the drake will desert the hen and join small flocks of other males. These small groups grow larger as males and non-breeding or unsuccessful females congregate as the season progresses. These small flocks of mallards were especially evident in Section 1 during the boat survey. A total of 74 mallards was seen during boat surveys June 26, 27 and 28. Many of these were males in eclipse plumage.

American widgeon were evident in both Sections 1 and 2 during the breeding surveys. Eighty-five of the 121 widgeon seen in Section 1 were in one large flock. The remainder, mostly males, were in small post-breeding flocks. Widgeon are typically late nesters (Hochbaum 1944). They reach their peak nesting period at least two weeks after mallards.

Smith and Hawkins (1948) state that it is common for widgeon to congregate in small flocks and even remain paired for long periods of time, but make few attempts at nesting. In some areas, as many as 60% of the pairs will not attempt nesting. No nests or young were seen this year on Southern Indian Lake. Hochbaum (1969), however, noted many widgeons with broods along the Churchill River and its lakes.

Other species of dabblers on Southern Indian Lake were not often observed (Table 7). Pintails were seen in Lake Section 1. Blue-winged teal were not seen on the lake during any of the surveys. It is possible that this duck might use the lake, but is probably an infrequent visitor. Littlefield and Pakulak (1970) reported blue-winged teal breeding in the Churchill area. Shovelers have been seen near Thompson (Johnson 1970) and Churchill (Jehl 1970) but were not observed on Southern Indian Lake.

Black ducks (Anas rubripes) were not seen in spring or summer but one large flock was seen during the fall staging period. There is evidence of black ducks breeding in the Churchill area (Pakulak and Littlefield 1968), but no evidence exists for Southern Indian Lake.

Five species of diving ducks and both species of mergansers probably breed on Southern Indian Lake. Lesser scaup and goldeneye were the most abundant "divers." Because of similarity in appearance, scaup could not always be identified as lesser or greater (Aythya marila). It is certain, however, that all of the breeding scaup were lesser. Undoubtedly, many more goldeneye nest in the Southern Indian Lake area than the number of pairs per mile of lake shore would indicate. This species is a tree nester and most of its nest sites are in large trees. It frequents small lakes and ponds during breeding season. Large flocks of goldeneye of both sexes were seen in the spring. Non-breeders typically gather in large groups and remain in these flocks throughout the summer. Some of the smaller flocks may have been like those described by Dzubin (1969b) as birds waiting to breed. Buffleheads (Bucephala albeola) were not seen on the lake but might occur (Godfrey 1970).

Only one pair of ring-necked ducks (Aythya collaris) was observed in Section 1, but this species probably does breed regularly on Southern Indian, (Johnson 1970). Jehl (1970) does not list this bird as a breeder in the Churchill area.

TABLE 7

PAIRS OF DUCKS, GEESE AND LOONS PER MILE OF SHORELINE, SOUTHERN INDIAN LAKE, JUNE 1973

(Unadjusted survey data)

	LAKE SECTION							
	1) MUSKWESI-WADDIE		2) MISSI RAPID		3) LONG POINT		4) CENTRAL SOUTHERN INDIAN	
SPECIES	A*	B**	A	B	A	B	A	B
Canada Goose	.08				.03		.01	
Green-winged Teal				.04				
Mallard	.02	.15						
Pintail	.02							
American Widgeon	.02	.15		.23				
Dabbler Sp.	.02	.02						
Common Goldeneye		.02		.09			.03	
Ring-necked Duck		.02						
Scaup Sp.		.06		.04				
Surf Scoter			.03		.02			
White-winged Scoter		.04	.03	.04				
Diver Sp.	.02	.02						
Merganser Sp.	.04		.14		.02		.01	
Duck Sp.	.08	.02	.03	.04				
Common Loon	.02	.08	.03	.23			.01	
TOTAL	.31	.58	.28	.73	.07		.06	

* A - aerial reconnaissance

**B - boat reconnaissance

Small flocks of scoters remained on Southern Indian Lake until at least the end of June. Pairs and lone males of both white-winged scoter (Melanitta deglandi) and surf scoter (M. perspicillata) were evidence that a few of these birds may breed on Southern Indian Lake. The lake is probably more important as a spring migration stop-over than a breeding area.

Endangered diving duck species such as the redhead (Aythya americana) and canvasback (Aythya valisineria)are not expected to use Southern Indian Lake.

Southern Indian Lake offers little nesting habitat for Canada geese but the small ponds and muskeg areas which drain into it are probably used to a moderate extent. Canada geese typically nest on muskrat houses or small islands in these ponds and use large lakes or rivers after the brood has hatched (Ryder 1972).

Whistling swans do not breed on Southern Indian Lake. With the exception of the area around Churchill they breed in the far north. Several large flocks have been seen in the early spring by natives of Southern Indian Lake (Goulden et al 1968).

Common loons were frequent breeders compared to most species. They were most abundant along the rocky shores in Section 2. Loons prefer to nest on islands where they build their nest very close to shore.

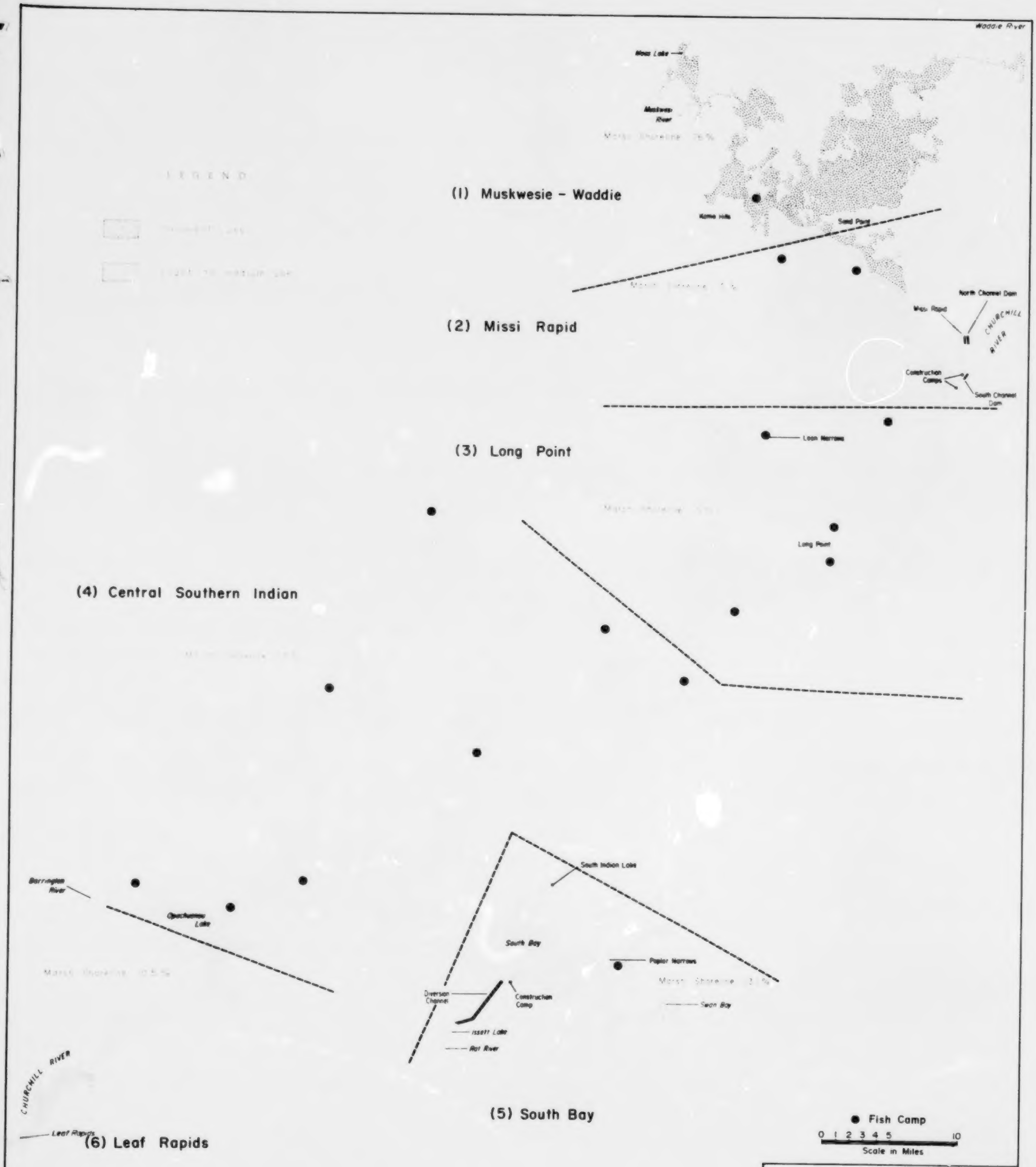
Figures of .5 pairs of ducks per mile of shoreline were observed in both Lake Sections 1 and 2. Adjusting for late period when surveys were conducted, there may have been 2 pairs per mile of shoreline in the northern lake sections at peak breeding period. Greater averages occurred in small areas of better marsh habitat. Townsend (1969) gave a similar figure for all of Lake Winnipeg but also stated that primary habitat in the Netley-Libau marshes had 23.2 ducks per mile of shoreline in 1965. Dzubin (1969a) found 2.35 and 14.1 pairs per mile of pothole shoreline in Roseneath, Manitoba and Kindersley, Saskatchewan, respectively, and many more species were involved. Estimates of pairs for northern sections of Southern Indian Lake are comparatively high when it is considered that only 8 species are involved. However, Sections 1 and 2 have only 246 miles of shoreline, about 20% of the lake total.

During years of low water on the southern prairies, ducks fly to northern areas (Crissey 1969). Although production is generally lower in the north a buffering effect is provided that may keep populations above threshold levels during years of drought (Crissey op. cit.). Areas such as Southern Indian Lake may offer this kind of alternate nesting habitat.

Staging

Most numerous species using Southern Indian Lake for staging were common goldeneye, lesser scaup, mallard and mergansers (Table 8). A total of 1,973 waterfowl was counted in Section 1 on September 27. Total for the entire lake was 2,519 ducks, geese and swans compared to many thousands on the Outlet Lakes in the previous year. Eighty-nine percent of all waterfowl observed on Southern Indian Lake were observed in lake Section 1. Only 667 waterfowl were seen on the lake during surveys on September 6. Large flocks of goldeneyes and lesser scaup contributed greatly to the increase from early to late September. Concentrations of mergansers were found in open water areas in the South Bay and Muskwesi-Waddie Sections (Map 4).

Scoters were not seen on Southern Indian Lake after late June. Use by scoters may be slight in late fall as some small flocks were observed by C.W.S. personnel in mid-October, 1968. Most of the early migrants, e.g., green-winged teal and American widgeon, were not seen during flights in late September.


Waddie River
Moss Lake
Muskwesie River
Marsh Shoreline 26%
LEGEND
(1) Muskwesie - Waddie
Sand Point
Marsh Shoreline
North Channel Dam
Missi Rapid
CHURCHILL RIVER
(2) Missi Rapid
Construction Camps
South Channel Dam
Loon Narrows
(3) Long Point
Marsh Shoreline
Long Point
(4) Central Southern Indian
Barrington River
Opachuanau Lake
Marsh Shoreline 10.5%
South Indian Lake
South Bay
Poplar Narrows
Marsh Shoreline
Swan Bay
Diversion Channel
Construction Camp
Issett Lake
Rat River
CHURCHILL RIVER
Leaf Rapids
(6) Leaf Rapids
(5) South Bay
● Fish Camp
0 1 2 3 4 5 10
Scale in Miles

MAP 4

WATERFOWL STAGING AREAS

(SEE APPENDIX 4)

SOUTHERN INDIAN LAKE - MANITOBA

LAKE WINNIPEG,
CHURCHILL AND NELSON RIVERS
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TABLE 8

WATERFOWL OBSERVED ON SOUTHERN INDIAN LAKE, JUNE 17, SEPTEMBER 6 AND 27, 1973.

Species	LAKE SECTION														
	1) MUSKWESI-WADDIE			2) MISSI RAPID			3) LONG POINT			4) CENTRAL SOUTHERN INDIAN			5) SOUTH BAY		
	17/6	6/9	27/9	17/6	6/9	27/9	17/6	6/9	27/9	17/6	6/9	27/9	17/6	6/9	27/9
Whistling Swan		13	13											19	
Canada Goose	8	2	18				4								
Black Duck			104												
Green-winged Teal		7													
Mallard	20	174	109			10								27	6
Pintail	2													7	
American Widgeon	2	12													
Dabbler sp.	11									5					
Common Goldeneye		105	1068			12				3		6			59
Ring-necked Duck					30										
Scaup sp.	22	185	465	5											85
Merganser sp.	205	6	130	57	5		13	21	12	8		1			322
Surf Scoter				4			7								
White-winged Scoter				1											
Scoter sp.				98			41			30					
Diver sp.	2		29		30			5		6					5
Duck sp.	36	19	41	1		18									
Common Loon	1			1						3					11
TOTALS	309	523	1987	167	65	40	65	26	12	55		7		53	488

TABLE 9

WATERFOWL USE OF SOUTHERN INDIAN LAKE

SPECIES	USE	LAKE SECTION(S) PREFERRED	HABITAT PREFERENCE
Whistling Swan	Spring and fall migration	1,5	Marsh, shallow areas in rivers for feeding. Deep, open water for staging and loafing
Canada Goose	Spring and fall migration	1,2	Marsh, meadows, muskeg for nesting. Grassy shores and river banks for feeding
Black Duck	Spring and fall migration (not common)	1	Marsh, mud flats for feeding and loafing
Green-winged Teal	Spring and fall migration, possibly breeding	1	Marsh, shallow rivers for feeding and loafing. Low sediment shore or beach with scrub for nesting
Mallard	Spring and fall migration, breeding	1,5	Marsh, mud flats for feeding, loafing. Low sediment shore, scrub or forest near shore, meadow for nesting
Pintail	Spring and fall migration, breeding	1,5	Marsh, mud flats for feeding, loafing. Low sediment shore, scrub, grassy areas for nesting
American Widgeon	Spring and fall migration, breeding	1,2	Marsh, shallow open areas with submergents; low shores for feeding and loafing
Common Goldeneye	Spring and fall migration, breeding	1,3, 4,5	Open water, protected bays for feeding and rafting. Ponds and muskeg with old trees for nesting
Ring-necked duck	Spring and fall migration, breeding	1,2	Marsh, sedge meadows, bogs for feeding and nesting
Scaup (Lesser and Greater)	Spring and fall migration, (lesser and greater), breeding lesser	1,5	Open water, small bays for rafting and feeding. Sedge meadows, low islands for nesting (lesser)
Scoter (White-winged and Surf)	Spring and fall migration, breeding, non-breeders over summer	2,3,4	Open water, near shore for rafting and feeding. Low shoreline, scrub for nesting
Merganser (Common and Red-breasted)	Spring and fall migration, breeding	1,2,6	Clear, open water near shores, rivers for feeding. Treed muskeg (common), low shore or rocky area (common and red-breasted) for nesting
Common Loon	Breeding	1,2, 4,5	Clear, open water for feeding. Small islands, low shore for nesting

Flights by the Canadian Wildlife Service in mid-October, 1968 revealed that Southern Indian Lake can have flocks of "divers" even in late fall. Goldeneye were most abundant. A total of 69 Canada geese was seen on the lake in 1968, mostly in Section 6. Mallards were the only "dabblers" observed, and most of these were below Opachuanau Lake.

Whistling swans are common on the Churchill River during the fall and apparently use Southern Indian Lake to a limited degree for staging. None were observed in 1968 but a few family groups were seen in the Muskwesi-Waddie Section in late September 1973.

Human Utilization of the Waterfowl Resource

A total of 421,677 migratory game bird hunting permits was sold in Canada in 1972, the latest year for which data are available. Approximately 10% (41,133) of these licences were purchased in Manitoba; 93% by residents. Total Manitoba kill of migratory game birds, excluding coots (*Fulica americana*), snipe (*Capella gallinago*) and sandhill cranes (*Grus canadensis*), was 420,098, (Cooch et al 1973).

Fewest ducks and geese are shot in the northern stratum (Table 10) but hunters usually spend longer periods in the field and achieve greater success, especially with geese. The area north of Flin Flon and the Outlet Lakes and northeast of Lake Winnipeg receives only 0.8% of the total waterfowl hunting pressure and yet accounts for about 3% of the duck harvest and 15% of the goose harvest in Manitoba (DMREM unpub.).

Mallards are the most important bird in both southern and northern Manitoba (Table 11) comprising 57% of the total duck harvest in 1972. Blue-winged teal, green-winged teal and lesser scaup made up most of the remainder of the bag - 18% of the total in 1972.

TABLE 10

WATERFOWL HARVEST AND HUNTER SUCCESS RATE, MANITOBA 1971-1972*

	STRATA	Birds Harvested 1971	Birds Harvested 1972	Birds Per Hunter 1971	Birds Per Hunter 1972
Sport Ducks	1	268,516	327,392	12.20	12.99
	2	63,716	28,781	12.33	12.87
	Total	332,232	356,173	12.23	12.98
Canada Geese	1	31,598	43,073	3.30	3.19
	2	12,060	4,485	4.88	4.61
	Total	43,658	47,558	3.62	3.29
Other Geese	1	9,817	15,180	2.60	2.78
	2	2,406	2,048	4.35	4.60
	Total	12,223	17,228	2.83	2.91
Sea Ducks**	1	553	21	3.39	1.00
	2	618	0	4.75	0
	Total	1,171	21	4.00	1.00
Total		389,284	420,980		

* - from Cooch, Kaiser and Wight (1973), 1972 data include a subsample of those hunters who did not purchase a licence in 1971. Data are from south of 53°N (No.1) and north of 53°N (No. 2).

** - eiders, scoters, oldsquaws

TABLE 11

ESTIMATED RETRIEVED KILL OF NUMERICALLY IMPORTANT DUCK SPECIES IN MANITOBA, 1970-1972*

		Retrieved Kill			
		1970-71		1971-72	
Species	Strata	Number	Per cent	Number	Per cent
Mallard	1	265,464		164,172	
	2	34,814		24,901	
	Total	300,278	57.96	189,073	56.91
Gadwall	1	14,330		12,125	
	2	125		566	
	Total	14,455	2.79	12,691	3.81
American Widgeon	1	21,072		10,195	
	2	1,621		1,699	
	Total	22,693	4.38	11,894	3.58
Green-winged Teal	1	18,264		16,394	
	2	1,683		650	
	Total	19,947	3.58	17,044	5.13
Blue-winged Teal	1	25,451		27,026	
	2	2,060		648	
	Total	27,511	5.31	27,674	8.33
Shoveler	1	12,636		7,823	
	2	368		416	
	Total	13,004	2.51	8,239	2.48
Pintail	1	30,255		15,607	
	2	4,198		4,294	
	Total	34,453	6.65	19,901	5.99
Redhead	1	17,106		8,796	
	2	250		407	
	Total	17,356	3.35	9,203	2.77
Canvasback	1	5,851		4,190	
	2	366		395	
	Total	6,217	1.20	4,585	1.38
Lesser Scaup	1	29,204		14,121	
	2	1,778		1,185	
	Total	30,982	5.98	15,306	4.61
Ring-necked Duck	1	15,849		7,903	
	2	1,352		170	
	Total	17,201	3.32	8,073	2.43
Goldeneye	1	4,166		2,615	
	2	238		634	
	Total	4,404	0.85	3,249	0.98
Bufflehead	1	3,452		1,993	
	2	123		0	
	Total	3,575	0.69	1,993	0.060

---

* from Cooch, Kaiser and Wight (1973). 1972 data include a subsample of those hunters who did not purchase a licence in 1971. Data are from south of 53°N (No. 1) and north of 53°N (No. 2).

About 60% of the Canada geese harvested in Manitoba are B.c. interior (Eastern prairie flock) and 12% are B.c. maxima. Manitoba hunters normally take less than 25% of B.c. interior; most of the remainder are shot in the United States. The harvest in the province takes place in central and southern sections (DMREM unpubl.).

Historically, there has been very little sport hunting on Southern Indian Lake. Duck and goose kills by licenced hunters are negligible. Major hunting pressure on waterfowl comes from natives. It has been estimated by the Socio-economic Study that waterfowl provide a total of 1400-1500 meals per year for members of South Indian Lake community. About 1,000 ducks and geese would have to be shot to supply this quantity of food. Hunting of ducks and geese is opportunistic and occurs in areas close to the community or fish camps during peak waterfowl periods in spring and fall.

6.1.4.2 Larids

Three species of gulls and two species of terns were observed on Southern Indian Lake. Herring gulls (Larus argentatus) and ring-billed gulls (Larus delawarensis) were common breeders. No evidence was found that Bonaparte's gull (Larus philadelphia) nested on the lake, but several of these birds were observed in the Muskwesi-Waddie section throughout the summer. Both common terns (Sterna hirundo) and Caspian terns (Hydroprogne caspia) were found nesting in one colony (Table 12).

Ten islands were identified by F.F. Slaney personnel as locations of nesting colonies. Gulls were the only nesters at seven sites while three had mixed colonies of gulls and terns (Appendix 5).

All the colonies were on small, rocky islands at least several hundred yards from shore. Vegetation was sparse, and usually consisted of small patches of willows and grasses.

TABLE 12

GULL AND TERN COLONIES SURVEYED ON SOUTHERN INDIAN LAKE, JUNE 1973

Colony	Lake Section	Location	Approx. No. of Nests	Nests and clutch sizes	Description of Island
1	2	57°,21',56"N 98°,10',22"W	H. Gull-30	20N - 3e	small rocky islet, ca. 1 ac: with 65% willow cover (clumps)
				11N - 2e	
				1N - 1e,1y	
2	2	57°,19',57"N 98°,11',29"W	H. Gull-150	4N - 4e	rocky reef, ca. ½ ac. with sparse vegetative cover (grasses and forbs)
			R.B.Gull-10	104N - 3e	
				32N - 2e	
				17N - 1e	
				1N - 2e,1y	
				1N - 1e,2y	
3	2	57°,19',24"N 98°,09',45"W	R.B.Gull-350	1N - 5e	small rocky islet, ca. 3/4 ac. with 45% vegetative cover (willows, grasses and forbs)
				6N - 4e	
				212N - 3e	
				96N - 2e	
				34N - 1e	
				1N - 1e,1y	
				1N - 2e,1y	
				1N - 1y	
				1N - 1e,3y	
4	1	57°,31',18"N 98°,25',37"W	R.B.Gull-160	61N - 3e	long, narrow islet, ca. 3/4 ac. in 2 sections: west, 40% vegetative cover (willows, grasses and forbs): east, 25% vegetative cover (grasses and forbs)
				65N - 2e	
				32N - 1e	
			Casp.Tern 150	16N - 3e	
				106N - 2e	
				32N - 1e	

e - eggs N - nests y - hatched young

TABLE 12 (CONT'D)

GULL AND TERN COLONIES SURVEYED ON SOUTHERN INDIAN LAKE, JUNE 1973

Colony	Lake Section	Location	Approx. No. of Nests	Nests and clutch sizes	Description of Island
			Com.Tern-92	17N - 3e	
				40N - 2e	
				35N - 1e	
			L.Scaup - 2	1N - 9e	
				1N -10e	
5	1	57°,28',41"N 98°,28',30"W	H.Gull - 8	2N - 2e	small reef, ca. ¼ ac. with large rocks and sparse vegetative cover
				1N - 1e,1y	
				1N - 2e	
				1N - 3y	
6	1	57°,37',17"N 98°,18',00"W	Terns	Not visited by boat	
7	2	57°,26',04"N 98°,16',52"W	Gull sp.	Not visited by boat	
8	3	57°,23',40"N 98°,26',15"W	Gull sp.	Not visited by boat	
9	3	57°,09',58"N 98°,16',59"W	Gull sp.	Not visited by boat	
10	3	57°,06',40"N 98°,20',00"W	Gulls and Terns	Not visited by boat	

Herring gulls were the only nesters on two of the islands (Colonies 1 and 5). Ring-billed gulls occupied Colony 3 exclusively, and both herring and ring-billed gulls were found in Colony 2. A mixture of Caspian terns, common terns, ring-billed gulls and lesser scaup were found on Colony 4.

Nesting chronology was further advanced for ring-billed gulls around Missi Rapid than for the same species in Section 1. No similar difference in chronology was observed for herring gulls. The average numbers of eggs per nest were higher in both species of gull nests in Section 2 than in Section 1.

In 353 ring-billed gull nests, the average number of eggs was 2.58. This is lower than 2.87 found by Vermeer (1970a) or 2.84 found by Johnston and Foster (1954). The numbers of eggs in herring gull nests (2.60 Colony 1, 2.20 Colony 2) was also lower than other authors have recorded. Paludan (1951) found 2.76 and 2.91 eggs per nest in two colonies he studied.

Islands selected by gulls for nesting are usually far enough removed from shore to prevent predation by mammals. These sites are generally free of vegetation because as Vermeer (1970a) suggests, these large, conspicuous birds must nest in locations where they can easily watch for predators. Nest locations are usually between small boulders, in depressions. Gulls are early nesters and will use those parts of islands from which the snow has disappeared in early spring. Nest initiation is usually concomitant with the availability of food in northern regions (Vermeer op. cit.). Some gulls must have begun laying eggs early in the last week of May in 1973, as several nests contained hatched young by June 23. Vermeer (op. cit.) gives the incubation period for herring and ring-billed gulls as 27 and 25 days respectively.

Photo 15 - Gull colony #3.
Barrenness of the
island is evident.

Photo 16 - Gull colony #3.
This island had
353 Ring-billed
gull nests.

Photo 17 - Gull colony #4.
Ring-billed gulls,
common terns and
scaup nested among
vegetation and rocks.
Caspian terns nested
on open sand.

The peak hatching period for gulls in the area is probably the last week of June and the first week of July. Older birds begin nesting earlier and have higher success than younger, inexperienced birds.

Vermeer (1970a) states that larger colonies usually have higher hatching success than smaller colonies because of reduced predation. Experienced nesters often return to exactly the same nest-site, and inexperienced birds nest on the fringe of colonies or move to new areas (Vermeer op. cit.).

Scaup are frequent cohabitants with gulls on nesting islands. Hatching success is usually high, but survival of young past four days is rare, due to predation by gulls. Odin (1957) states that most species of ducks are not safe from predation by gulls until they have reached three-quarters of full growth.

The observation of Caspian terns nesting on Southern Indian Lake represents an extension of the known breeding range of these birds. Frisch (1969) reported seeing a large flock of Caspian terns on a reef in Lake Waskaiowaka, Manitoba, but he did not see any evidence of their nesting. Sightings of Caspian terns at Churchill (Jehl 1970) have been made, but evidence of breeding is lacking there also. It is not known in how many of the colonies not visited by boat Caspian terns were nesting, but these birds were seen flying near some of the southern nesting islands. Common terns probably do not breed much further north than Southern Indian Lake in north-central Manitoba. They have been described by Mowat and Laurie (1959) as nesting at Kasmere Lake.

Caspian and common terns often share the same island in southern Manitoba (Vermeer 1970b). These birds begin nesting later than gulls in the same area. Peak nesting period of Caspian terns is approximately one to two weeks later than that of common terns (Vermeer 1972). Nest initiation is usually dependent on the availability of small fish at the water surface. Later disappearance of ice generally precludes early nesting.

Average numbers of eggs in Caspian and common tern nests were 1.89 and 1.81 respectively. Godfrey (1966) states that the average common tern nest contains three eggs, but two or four eggs is not uncommon. Caspian terns usually lay two or three eggs.

Caspian terns seem to favour sandy areas for nesting. The nest site is often just a depression in the sand. Occasionally, there may be some grass in the floor of the nest. Nests of common terns on the colony visited were constructed of dried vegetation and were similar to the ring-billed gull nests found.

Like gulls, terns select islands removed from shore to minimize mammalian predation. They nest in dense colonies in locations which afford 360° vision.

The presence of large numbers of gulls and terns on Southern Indian Lake is probably related to several factors, including availability of islands suitable for nesting, lack of disturbance (human), and early availability and abundance of food. Many of these birds probably depend on the early break-up of ice both above and below Missi Rapid for their sustenance during early spring.

6.1.4.3 Raptors

Bald eagles (Haliaeetus leucocephalus) were commonly seen along the shores of Southern Indian Lake (Table 13). Five of these large,

TABLE 13

SIGHTINGS OF BALD EAGLES, OSPREYS AND GOSHAWKS SOUTHERN INDIAN LAKE, MANITOBA, 1973

DATE	BALD EAGLE	OSPREY	GOSHAWK	LOCATION (Lake Section)
June 17	1 ad.			3
June 17	1 imm.			2
June 17	2 ad.			2
June 17	1 ad.			4
June 17		1		2
June 17			1	3
June 23	2 ad.			2
June 27		1		1
Sept. 6	2 ad.			4
Sept.27	1 ad.			1

ad. - adult

imm. - immature

fish-eating birds were seen on the June 17 flight. Only one immature eagle was seen during the summer. Several pairs were observed throughout the field season, but only one nest site near Missi Rapid was confirmed.

Ospreys (Pandion haliaetus) were observed on two occasions on the northwestern side of the Lake. The Archaeology crew working at Sandhill Bay reported seeing one of these birds most of the summer. A goshawk (Accipiter gentilis atricapillus) was observed above Long Point on June 17.

Other hawks observed during the summer included the red-tailed hawk (Buteo jamaicensis), and marsh hawk (Circus cyaneus).

The attraction of Southern Indian Lake to fish-eating bald eagles and ospreys is evident, i.e., an abundant supply of food and lack of disturbance. Both of these raptors are considered rare and endangered species in Manitoba (Godfrey 1970). The goshawk is not common and is most likely to be found in remote areas (Godfrey 1970).

6.1.4.4 Other Birds

A parasitic jaeger (Stercorarius parasiticus) was observed in Section 1 in late June. No evidence of breeding was observed. These birds do breed in northwestern Manitoba (Godfrey 1966).

Indication of breeding by territorial male red-winged blackbirds (Agelaius phoeniceus) represents an extension of the known range of this species. Several of these birds were seen in the marshes in the Muskwesi-Waddie Section. Jehl (1970) indicates that this blackbird is an infrequent visitor to Churchill, but no evidence of breeding has been seen. Rusty blackbirds (Euphagus carolinus) were also seen in Section 1.

A rich variety of passerines inhabits the wetlands and forested uplands of Southern Indian Lake. In a one-mile census around Missi Rapid in late June, 35 pairs of territorial males were counted (Table 14). Most common were yellow (*Dendroica petechia*), Tennessee (*Vermivora peregrina*) and Myrtle warblers (*Dendroica coronata*), song (*Melospiza melodia*) and chipping sparrows (*Spizella passerina*).

A differencein habitat preference by birds along the shorelines became evident throughout the summer. Several species were observed most often in the willow-sedge-beach type of habitat, while others preferred forest-upla[illegible] (Table 15).

TABLE 14

BREEDING BIRDS RECORDED ALONG A TYPICAL MILE OF LOW BEDROCK SHORELINE IN LAKE SECTION 2 (MISSI RAPID)*

Species	Territorial Males	Pairs	Family
Canada Goose			M , F , 3 goslings
Mallard			F & 8 ducklings
Boreal Chickadee		1	
Chipping Sparrow	3		
Fox Sparrow	1		
Killdeer		1	
Myrtle Warbler	3		
Northern Waterthrush	1		
Ruby-crowned Kinglet	2		
Slate-coloured Junco	1		
Song Sparrow	3		
Spotted Sandpiper	3		
Swainson's Thrush	2		
Tennessee Warbler	4		
White-crowned Sparrow	2		
Yellow Warbler	6		
Totals	31	2	2

* - 90% rocky shoreline with sedge-willow border

TABLE 15

BREEDING BIRDS ASSOCIATED WITH WILLOW-SEDGE-BEACH HABITAT* AND UPLAND-FORESTED AREAS, SOUTHERN INDIAN LAKE, FROM OBSERVATIONS BY F. F. SLANEY PERSONNEL, 1973

WILLOW-SEDGE-BEACH	FOREST-UPLAND
Canada Goose	Blackpoll Warbler
Mallard, Widgeon, Other Dabbling Ducks	Boreal Chickadee
Scaup, Goldeneye, Other Diving Ducks	Chipping Sparrow
Common Snipe	Fox Sparrow
Killdeer	Magnolia Warbler
Lincoln's Sparrow	Myrtle Warbler
Northern Waterthrush	Robin
Song Sparrow	Ruby-crowned Kinglet
Spotted Sandpiper	Slate-coloured Junco
Swamp Sparrow	Swainson's Thrush
Traill's Flycatcher	Tennessee Warbler
White-crowned Sparrow	Yellow-shafted Flicker
White-throated Sparrow	
Wilson's Warbler	
Yellow Warbler	

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* Medium-steep slope with alluvial or coarse sediments or low shoreline types

6.2 IMPACT OF DEVELOPMENT

Over 1,200 miles of shoreline and adjacent lands, totalling approximately one hundred and seventy square miles, will be flooded when the water is raised behind the Missi Rapid and Notigi structures. Knowing the extent of marshes and shoreline types on the lake, general assessment of the impact of flooding on wildlife dependent on these areas can be made. The length of time for re-establishment of suitable shorelines will be a major limiting factor.

6.2.1 Shorelines

Effect of flooding on different types of shoreline will be dependent on several factors. Included among these are slope, bedrock control, depth of overburden, type of overburden (clay or coarse sediments), depth and type of organic material, type of vegetation and extent of rooting, survival of vegetation, resistance of substrate to erosion and wave and wind action. The following sections represent the author's interpretation of preliminary material received from members of the Impact Study Group. It is recognized that further analysis may lead to slightly differing conclusions in their final report.

Steep bedrock will be affected very little by flooding. Where flooding does reach the forested zone however, soil and trees will be washed away quickly. The time will vary slightly with the type of overburden, i.e., clay or coarse sediment. Soil is usually washed away well above the waterline due to wave and wind action. If the deciduous or mixed-wood fringe is killed by flooding, re-establishment could take several years, but willow might come in beneath the dead overstory. In some protected bays, sufficient beach development might occur to allow growth of some emergents, but this would take many years. Enough fine material could be deposited in small areas between rocks to allow establishment of a few forbs and willows in the water-washed zone.

Due to a gentler slope, low bedrock shorelines will be affected more by flooding than steep bedrock. Wind and wave action, type of substrate and vegetative cover will control the rate at which the shoreline becomes re-established. Generally, this type of shoreline reverts to its original state within a few years on exposed sites. In protected areas, erosion of the shoreline may take 15 - 20 years or longer. There may be a few standing, dead trees in the offshore zone. Development of beaches is slow and will occur first in areas where dead timber has been removed. Debris and standing timber in protected bays will not disappear for several years and will impede development of beaches and growth of aquatic vegetation.

All of the marshes, beaches, willow fringes and some of the mixed-wood zone will be inundated on low bedrock - controlled shorelines. Erosion may go on at least 30 years before the drowned timber disappears and a stable beach develops. In protected bays, aquatic vegetation may grow well within 5 - 10 years, but the sedge-willow fringe may not develop for several years. Depending on the type of material overlying the bedrock, and wave action, slumping may go on in the backshore for 30 - 50 years (Impact Study unpub.).

Impact on medium-steep shorelines in sediments will be more severe. Simply because of slope, the area flooded will be greater. In most cases, the deciduous fringe will be largely killed. Flooding may take place back to the coniferous forest.

Time to adjust will be quite long; it often takes 20 years for the timber to disappear and a beach to develop. Willows may seed in above the eroded bank within 5 - 10 years, depending on the moisture regime. Trees will disappear above ice-contact material faster than alluvial, but this will vary with the type and thickness of organic material on the substrate. Depending on the vegetation present and the type of substrate, development of a permanent shoreline may take several years.

Flooded muskeg often reverts to its original type quickly as 'islands' may float up and become re-established when they anchor.

Muskeg can also stagnate for some time after flooding as anaerobic conditions set in above the organic matter.

If willow and alder invade the dead spruce zone, it may take 20 - 50 years for extensive growth to develop. On bodies of water which are closely regulated, the more water-tolerant willow-alder zone will be thinner as spruce can grow closer to the waters' edge (Impact Study unpub.).

Fens usually re-establish themselves quite quickly. The organic mat will float with the rising water. By wave or ice action, islands become separated from the main body and float until they lodge against shore in a lee position. Very little of Southern Indian Lake is fen, and therefore occurrence of this process will be rare.

Since 64% of the lake is either steep bedrock or low bedrock, many reaches will adjust quickly to the raised water levels and appearance will be quite similar to that before flooding. Sections 3, 4 and 6 have 75.5, 78.3 and 72.9%, respectively, of their shoreline comprised of steep and low bedrock, and at least half of the remainder is bedrock-controlled. Most of the shorelines in these sections will adjust quickly to flooding. In the other three sections, however, relief is much lower, and the effect of flooding will be more severe.

6.2.2 Marshes

At the proposed regulated water level all of the marshes on Southern Indian Lake will be flooded. Some small marsh and muskeg areas near the lake will remain unflooded as they lie above the 850 ft. contour level, but many of the marsh-fringed creeks leading from the lake to these areas will be covered.

Approximately 10.5% of the peripheral shoreline on Southern Indian Lake is marsh. The area where loss will be greatest is the Muskwesi-Waddie Section; approximately 24% of the area within the floodline is marsh-muskeg. The South Bay Section also will lose several hundred acres of marsh. Even in sections where overall steep relief makes extensive marsh development impossible, there are many small marshes at the ends of protected bays, and along streams which flow into the lake.

Development of marshes after flooding will depend on several factors, e.g., type of shoreline flooded, type of vegetation flooded, wave action, and water level control. In most cases, if the flooding is over a low shoreline, marsh development will start immediately where contours are suitable but take at least 10 - 20 years. Re-establishment of some of the wide expanses of marsh in the north end may take 50 - 100 years, as in most cases the flooded muskeg and willow will severely retard growth of rooted aquatics. Where the beach becomes stable quickly, emergents such as sedge, bulrush, etc., may come in, but full development will depend on substrate. Pondweeds establish quickly and are most productive on soft silt-loams. Most aquatic plants grow best on black-silty loams.

The north end of Southern Indian Lake is very productive. One of the main reasons for this is the high transparency of the water (Cleough pers. comm.) which allows photosynthesis at considerable depths. Extensive beds of submergents may establish in 5 - 10 years in some flooded areas where depth is four feet or less and soil conditions are favourable.

When extensive areas of peat are flooded, the initial decomposition of the organic material uses up a lot of oxygen. After flooding, several important elements may be released into the water. Aluminum is released from clay; it can be toxic under acidic conditions (Cook and Powers, 1958). Concentrations of phosphorous may increase 100%; production of algae will be enhanced. Potassium is leached out and it is this element that will promote luxuriant growths of plankton and duckweeds. It is this initial increase in nutrients which often results in high productivity in newly flooded areas.

Once certain vegetation zones have become established, one of the best tools in marsh management is frequent change of water levels. Aeration of soils by draining and reflooding of drained areas aids in the recycling of nutrients. If done too often, however, more nutrients may be carried out of the system than are brought in. An overall decrease in productivity will ensue. Constant, stable water levels will allow establishment of permanent vegetative zones, but will result in stagnation over long periods.

6.2.3 Moose

The immediate effect of the development will be to flood existing browse and aquatic vegetation along shorelines, thereby eliminating some feeding areas for moose. All willow fringe will be lost on low shorelines. Carrying capacity of the area will be reduced until willows and other browse become re-established. Consequently, the native moose harvest will be directly affected. Most upland areas will not be affected. The only areas of good upland habitat are near the southern sections of the lake in old burns, mostly above the floodline.

Assuming a potential density between 0.25 and 0.5 moose per square mile for the flooded area of 173 square miles, loss of habitat for approximately 46 - 92 moose will occur (Table 16). The loss of habitat could result in loss of a potential harvest of 9 - 18 animals annually (20%). Moose may not use the new shorelines until vegetation is suitable; therefore shoreline hunting opportunity by the people of South Indian Lake will decrease. Moose will still be available in upland areas, however.

Several previous reports have attempted an estimate of losses in moose production and harvest. All of these, however, considered a rise in Lake level to the 870 foot level which would have affected a much larger area. Welch et al (1966) probably overestimated the utilization of moose by natives (2 to 10 shot annually per family) and production capability of the area (1.0 per square mile).

Goulden et al (1968) estimated a loss of 430 moose in the Southern Indian Lake area, based on a density of 0.5 per square mile, but again considered the area to be flooded at the 870 foot level.

Losses were estimated at 20% of the base population. No value of the moose harvests to residents of the area was given. Economic impact of losses in moose production was assessed by Underwood McLellan (1970) as $25,100 but is inappropriate as calculations were based on flooding to the 870 foot level.

Collinson et al (1973) estimated the value of each moose to residents at $600. If the average annual kill is approximately 35 moose this represents a value to the community of $21,000. Assuming that 75% of moose harvested are shot along shorelines (which agrees with the estimate by Underwood McLellan (1970)) then

TABLE 16

MOOSE HABITAT LOSS AND POTENTIAL NUMBER OF MOOSE AFFECTED, SOUTHERN INDIAN LAKE

Lake Section	Total Area * Affected (Square miles)	Estimated Number of Moose Affected **
1. Muskwesi-Waddie	35	9 - 18
2. Missi Rapid	14	4 - 8
3. Long Point	30	8 - 16
4. Central Southern Indian	70	18 - 36
5. South Bay	10	3 - 6
6. Leaf Rapids	14	4 - 8
Totals	173	46 - 92

* - Areas from Forest Inventory Data, DMREM

** - Calculated from an estimated winter densities of 0.25-0.50 moose per square mile.

75% or $15,750 of the value of the moose harvest would be lost after flooding unless adjustment is made in hunting patterns.

Increased access into the Study Area will lead to an increase in recreational hunting. Limited accessibility will prohibit most hunters from going into the northern sections. The South Bay area is accessible by road from Leaf Rapids and Thompson and may attract sport hunters from other communities. This could lead to an increase in moose hunting around Opachuanau Lake and South Bay.

Increased recreational hunting may result in a conflict with subsistence hunting by natives. As the area has a low production potential, management regulations may be necessary to allow natives to harvest sufficient moose for food and hides.

Some harassment of ungulates will occur with increased access to the area, but should not be of major concern.

6.2.4 Barren-ground Caribou

Barren-ground caribou are probably not dependent on lake shorelines for food. Their range therefore would be affected little by flooding of Southern Indian Lake to the 850 foot level. Use of the Study Area by caribou, at present, is limited to migration through the most northern section.

Inundation of marshes and muskeg in that area could disrupt but not seriously impede movement patterns, as the zone of migration also extends north of Southern Indian Lake (Parker, 1972).

As the affected area in the Muskwesi-Waddie Section is mostly marsh-muskeg and treed-muskeg, there will be limited loss of caribou winter range. Sedge meadows will be flooded and while this represents potential loss of some food for migrating caribou, large expanses of preferred winter range, open black spruce forest and muskeg, occur outside the Study Area.

With increased access into the Study Area resulting from the development project, a potential exists for disturbance of barren-ground caribou, should the southward migration extend further into the Study Area. Some harassment around maintenance camps and any future recreational developments could occur but because of their presence in winter only, would be minimal. Forest fires destroy caribou winter range and a higher forest fire threat is inevitable with increased recreational use of the area in summer.

Secure ice conditions are necessary for mobility of ungulates. Significant changes in water levels during winter could have an effect on caribou crossing the lake but under the proposed regulation scheme, the maximum winter drawdown would be less than 1.5 feet in most years. This is less than under natural conditions. Ice conditions should therefore remain suitable for caribou.

6.2.5 Furbearers

Furbearers will be directly affected by inundation of habitat. All marshes will be lost within the floodline. Furbearing animals will be displaced by rising water and will be lost to the area. They cannot be expected to find suitable habitat not already occupied by individuals of the same species.

Loss of habitat for beaver will result from partial inundation of creeks flowing into the lake. Inundation of food plants will occur with a 10 foot rise in lake level. Young deciduous growth along creeks will be lost. Total area of land inundated will be

173 square miles. If potential harvest of beaver in the area is considered as 0.5 per square mile as suggested by Collinson et al (1973), there will be a loss of potential harvest of approximately 90 beaver. Real losses cannot be calculated with existing information. Ninety beaver represent approximately 12% of the annual average beaver harvest in those RTL's affected by the project.

Lynx will be affected indirectly through the effect of flooding on prey species. Loss of shorelines will reduce the availability of prey. Partial loss of home range will result in displacement of some lynx. The effect on production potential of this species is unknown, but a decline is possible, especially in southern sections where trapping returns are highest. Large burns in Section 5 and 6 will not be affected by flooding so that prey availability will not be seriously affected in those areas.

Mink will be more affected as this species is dependent on shorelines for cover and food supply. Loss of productive shorelines such as marshes, creek mouths and low shorelines will reduce food supply. Mink will be displaced from inundated areas.

Muskrats will be affected by a loss of marsh habitat in the Muskwesi-Waddie and South Bay Sections and loss of small marshes throughout the Study Area. The loss of marsh habitat will result in a corresponding loss of production and hence potential income to trappers. Since harvest rates tend to be lower than those possible in terms of animal availability, real income loss will be an unknown amount less than the potential for loss.

Traplines along the lake will be affected to varying degrees by flooding, area lost ranging from 1 to 5%. As the area affected will be mostly productive shoreline, there will be a corresponding loss of fur production, potential or realized. The actual effect may be greater than the percent of land area lost. Shorelines and marsh areas, particularly in the southern sections where most of the trapping is done, probably contribute more to furbearer production and are trapped more intensively than inland areas. However, suitable habitat that will not be flooded exists for all furbearers within each RTL. The degree to which this habitat has been trapped, or could be trapped in future has not been determined.

Twenty-one RTL's will be directly affected by flooding (Map 2). Average annual values for the affected traplines are given in Table 17. Comparison of averages for the 1967-68 to 1971-72 period (5 years) with the last two seasons (1970-71 to 1971-72) indicates that returns have declined. This may change with current higher fur values.

Several earlier reports have considered economic losses from flooding, but with the previous scheme of a 37-foot rise in lake level, Goulden et al (1968) estimated area lost in individual RTL's as ranging from 1.5 to 50% and used these figures directly to arrive at economic loss. Welch et al (1966) gave values of those RTL's which would be affected but no estimate of the degree to which income would be affected.

Collinson et al (1973) have evaluated each of the RTL's to be affected by flooding and have assumed that these RTL's will not be harvestable after flooding. Economic losses would be substantial in that event - 70% of the total average annual value of the whole Registered Trapline Section. Economic losses will be less drastic than proposed by Collinson et al (1973). Traplines will contain suitable furbearer habitat along ponds, lakes and streams above the floodline.

TABLE 17

AVERAGE ANNUAL FUR HARVEST VALUES[a] OF AFFECTED REGISTERED TRAPLINES AND MILES OF FLOODED SHORELINE (SOUTHERN INDIAN LAKE)

RTL No.	Average Value for 1967/68 - 1971/72[b] (dollars)	Average Value for 1970/71 - 1971/72[c] (dollars)	Miles of Flooded Shoreline
1	1896	1343	104
2	2227	2063	80
4	3527	2660	89
5	1136	547	59
6	733(3)	587	44
9	672	869	160
10	205(3)	33	188
15	-	-	115
18	278(2)	-	5
19	211(1)	-	17
22	1053	437	104
23	209	130	96
24	1443(4)	1533(1)	100
25	353	490	33
29	791	460	15
33	1843	1986	36
34	2143	1610	38
35	1057	869	135
43	1301(2)	1301	113
52	361(3)	263(1)	48
54	2495	889	475

a - based on fur dealer records and average Winnipeg prices (See Appendices 8, 9-13)

b - 5 year and c - 2 year averages, except where values were calculated from number of years shown in brackets

One method of assessing the severity of impact to RTL's is to consider miles of shoreline which will be flooded within each RTL. (Table 17). Based on comparison of miles of shoreline affected and annual average production, those RTL's most severely affected will be numbers 1, 2, 4, 22, 24, 33, 35 and 54. Some RTL's, e.g. number 15, will be affected by loss of potential (i.e. 115 miles of shoreline) but as there has been no production over the past five years there will be no effect on current income to trappers.

6.2.6 Birds

6.2.6.1 Waterfowl

Flooding will render most of the area unsuitable to breeding waterfowl for several years, until shorelines and marshes become re-established. Tree-nesting species such as common goldeneye will benefit from the flooding, as more nest sites will be available. Many of these birds typically nest in small bogs removed from the Lake. Those species of ducks which prefer dense beds of emergents or low willow-covered shoreline for nesting will find very few suitable sites after flooding.

Not only will nesting sites be drastically reduced, but there will be little food available to ducklings and adult ducks. The young of most waterfowl select invertebrate material preferentially during the early growing period and then may change to a vegetarian diet. Production of invertebrates is directly related to occurrence and productivity of submergent vegetation (Krull 1967). As there will be few beds of submerged vegetation for 2-5 years in most marsh areas, abundance of available food will be low. Food, either plant or animal, is of no use to dabbling ducks at depths greater than 18 inches. Mallards and teal will select for seeds in submerged and emergent vegetation, whereas widgeon select for leafy, green material (pondweeds and milfoil). The use of sedge seeds by most species of Class II and III ducklings and adults is well known (Keith 1961). The extensive sedge meadows in the north end offer copious amounts of seeds to dabblers and divers. Until grasses and sedges become established along new shorelines, the lake will be less attractive to ducks and unattractive to Canada geese as a source of food.

Flooded timber can be highly productive of waterfowl (especially mallards and black ducks) if there are sufficient loafing and nesting sites, and plant and animal foods are abundant. This type of habitat could only be created where the water is shallow over wide expanses of forest floor. Production of duckweeds and invertebrates is high within 2-3 years after flooding. There is evidence however, that predation by mammals in flooded timber can severely limit nesting success (Thompson et al 1967).

The value of Southern Indian Lake to mergansers will probably not decrease significantly with flooding. These birds are fish-eaters and favour open water areas. If productivity of the lake increases after flooding, this might be reflected in the abundance of small fish and thus in the merganser population. The availability of nest sites however, might be somewhat limiting.

Loons will also have fewer nesting sites for several years, until emergent vegetation develops in the secluded areas this species prefers. Since loons feed on fish, their food supply should not be affected.

The value of Southern Indian Lake to staging waterfowl after flooding will vary a great deal between species. Fish-eating birds such as mergensers and loons will not be greatly affected. Ducks such as scaup and goldeneye that dive to considerable depths for invertebrate and plant material and raft in large flocks on open water may not be seriously affected although "traditional" feeding sites will be lost.

Dabbling ducks will find most of the area unattractive for several years until dense stands of emergent and submergent plants return. Production from an estimated 500 pairs of dabblers, mostly mallards and widgeon, will be lost in northern lake sections alone.

Swans are also "dabblers", and although their range of diving depth is greater, the roots and tubers they find in shallow water will not be there for some time after flooding.

Dead, flooded timber is often used by dabbling ducks as a loafing area in the fall. Ducks may fly to other areas to feed.

With the difference in flow patterns proposed under the regulation scheme, perhaps the only areas open to spring migrants will be in the areas around the community and in South Bay. The traditional sites around Missi Rapid may remain frozen with the reduced flow through the control structure.

6.2.6.2 Larids

All of the nesting islands presently used by gulls and terns will be completely flooded at the proposed water level.

If the level is raised during the winter, the nesting islands will be gone when the birds return in spring. Some birds may disperse to other lakes, but most will probably not find suitable nesting sites.

If regulation begins in early summer and water rises more than two feet during the nesting season, several thousand nests will be lost.

Use of the lake by gulls will be slight until natural or artificial processes create isolated, barren islands favoured for nesting colonies.

6.2.6.3 Raptors

Fish eating birds, eagles and ospreys, may lose some of their traditional resting and feeding areas, but generally the lake will still offer suitable habitat. If nesting trees are preserved, populations should not be affected.

Hawks and owls may not find the variety of small birds and mammals that presently abound along willow and mixed-wood shores. Species abundance may change and some of these raptors may move to more attractive areas, until the new shoreline becomes diversified and abundant in prey species.

6.2.6.4 Other Birds

The flooding of the willow-sedge-beach habitat on Southern Indian Lake will bring changes in bird species which frequent the area. Most of the shorebirds will disappear until shorelines become sufficiently re-established. White-crowned and white-throated sparrows and other passerines will suffer a reduction in habitat. Marsh dwelling species such as red-winged blackbirds will find no emergents to nest in for several years.

Some of the warblers and thrushes will still find favourable habitat. Where flooding has killed the productive deciduous zone however, value to upland bird species will be reduced.

6.3 POSSIBLE MITIGATION PRACTICES

Several practices could be implemented which would lessen the effect of the hydro development on wildlife resources and wildlife utilization patterns. It is understood that other evaluations may be required before implementation of any mitigation practice.

6.3.1 Modification of Proposed Flooding Schedule

To cause the least direct damage to wildlife, flooding should begin in late June or early July, 1975. If flooding starts in February, there will be extensive loss of muskrats and winter travel over the ice may be dangerous for trappers. Flooding in May or June will result in losses among nesting waterfowl, gulls and terns. Starting the rise in late June will allow most of these birds to hatch their clutches before nest sites are inundated.

6.3.2 Determination of Optimal Water Regimes

After the proposed level has been reached, careful examination should be made by wildlife and fisheries agencies to suggest management procedures to optimize the wildlife and fisheries resource. Water levels may be managed to aid in shortening the period of shoreline and marsh re-establishment.

Federal and provincial fisheries and wildlife agencies and Ducks Unlimited should meet to co-ordinate wildlife management plans for the lake. Concerns which should be foremost in management plans include optimum nutrient flow, habitat availability for fish and wildlife production and minimum loss of wildlife from improper water level control.

6.3.3 Clearing

Alternative sites for gull and tern nesting colonies can be provided by clearing and grubbing islands which will remain above the proposed level. Wind, wave and ice action would clear off most of the soil to leave the gravel and boulder-type of site these birds favour for nesting.

Recommendations for clearing were provided to the Study Board as follows:

"Gull and tern nesting islands in the form of rocky reefs were located in the summer (1973) during reconnaissance flights. Several were later visited by boat. Field work in June determined nesting species, numbers of nests and eggs, hatched young, species preference for nesting sites, vegetation and general physical nature of colonies.

"The following are recommendations for the clearing of small islands on Southern Indian Lake to provide potential alternative nesting sites. All existing colony sites will be inundated with the 850 feet reservoir level. No suitable replacement islands will materialize without assistance in the form of tree and brush clearing.

"From interpretation of aerial mosiacs and floodline maps, it is possible to suggest potential sites for clearing. These are islands which will be partially flooded as indicated by floodline maps. A small portion of an island would be left above flood level and if cleared would provide replacement sites for inundated nesting islands.

"Clearing of some primary sites could be done this winter, next winter, or after flooding. Winter of 1974-75 is advisable.

"The fisheries group has recommended clearing of some islands to provide new spawning sites. These islands could provide alternate nesting sites for gulls and terns if ½ acre or more is left unflooded but this is unlikely in most cases.

"The following requirements should be considered when a final decision is made on those islands to be cleared. Firstly, elevation must be higher than 850 feet, but not much higher than 855 feet. This would give a maximum elevation of 5 feet, which is slightly greater than the average height of existing nesting islands. Secondly, trees and large shrubs should be cut, uprooted and burned on all of the islands above flood level. Some small shrubs could be left in the center of the island if possible. Thirdly, an effort should be made to leave as much of the substrate as possible. Small pockets of soil should be left for the growth of forbs and grasses. These plants provide nesting material. Some areas of open sand should also be left for Caspian terns.

"On-site inspection by a biologist should precede any clearing to determine the best sites and extent of clearing."

Also, some clearing should be considered for the Muskwesi-Waddie area to aid in the re-establishment of willow-fringed and marsh shorelines. Clearing could take place after water levels are stabilized.

6.3.4 Avoiding Harassment of Nesting Birds

Special attention should be given to avoid harassment of nesting raptors and waterfowl around construction sites. Pilots should be instructed to avoid flying near known nesting sites.

6.3.5 Compensation for Loss of Trapping Income

There will be a potential loss of income to trappers of the community from the flooding of shorelines in twenty-one RTL's (Table 17). Losses will be most serious in RTL's close to the community. Compensation for loss of income to trappers should be considered. This could be in the form of financial aid or preferably through equivalent work alternatives. Compensation could be based on the miles of affected shoreline in each RTL (Table 7).

Those trappers which are seriously affected may be granted trapping privileges on RTL's which are currently under-utilized. Revision of trapline boundaries could also be considered.

Alternative employment in other resource based industries could be offered. Areas of employment could include pulp cutting, timber clearing or other construction related activities.

A fur management plan should be developed for the area to increase production. Many traplines appear to be under-utilized at present. A program of trapper education and the establishment of a fur co-operative would be helpful in realizing better fur returns. Fur handling and quality would be upgraded and trapper efficiency increased. Motivation among trappers would be higher if prices from fur sales were at least equivalent to prices obtained at Winnipeg auction houses.

6.3.6 Game Harvest Control

A management plan should be devised to regulate the harvest of moose in areas readily accessible to recreational hunters. Residents of South Indian Lake should be allowed to harvest the number of moose required for their use without interference from recreational hunters. Such a management plan could involve setting quotas, restricting open seasons or closing certain areas to recreational hunters.

A system of collecting moose harvest data from residents of the community is needed. The location of moose kills and areas favoured for hunting by residents should be determined. A study of resident utilization of ungulates would be useful. The role of wildlife as a source of food for residents of the community should be determined by such a study.

6.3.7 General Camp Practices

Proper incineration of refuse and litter would reduce the attraction of bears and wolves to camp areas and thereby minimize disturbance to wildlife.

All employees involved in construction and related activities, especially pilots, should be instructed to avoid harassment of waterfowl, gull and tern colonies, eagles and ospreys, moose and caribou.

PART 7

APPENDICES

APPENDIX 1

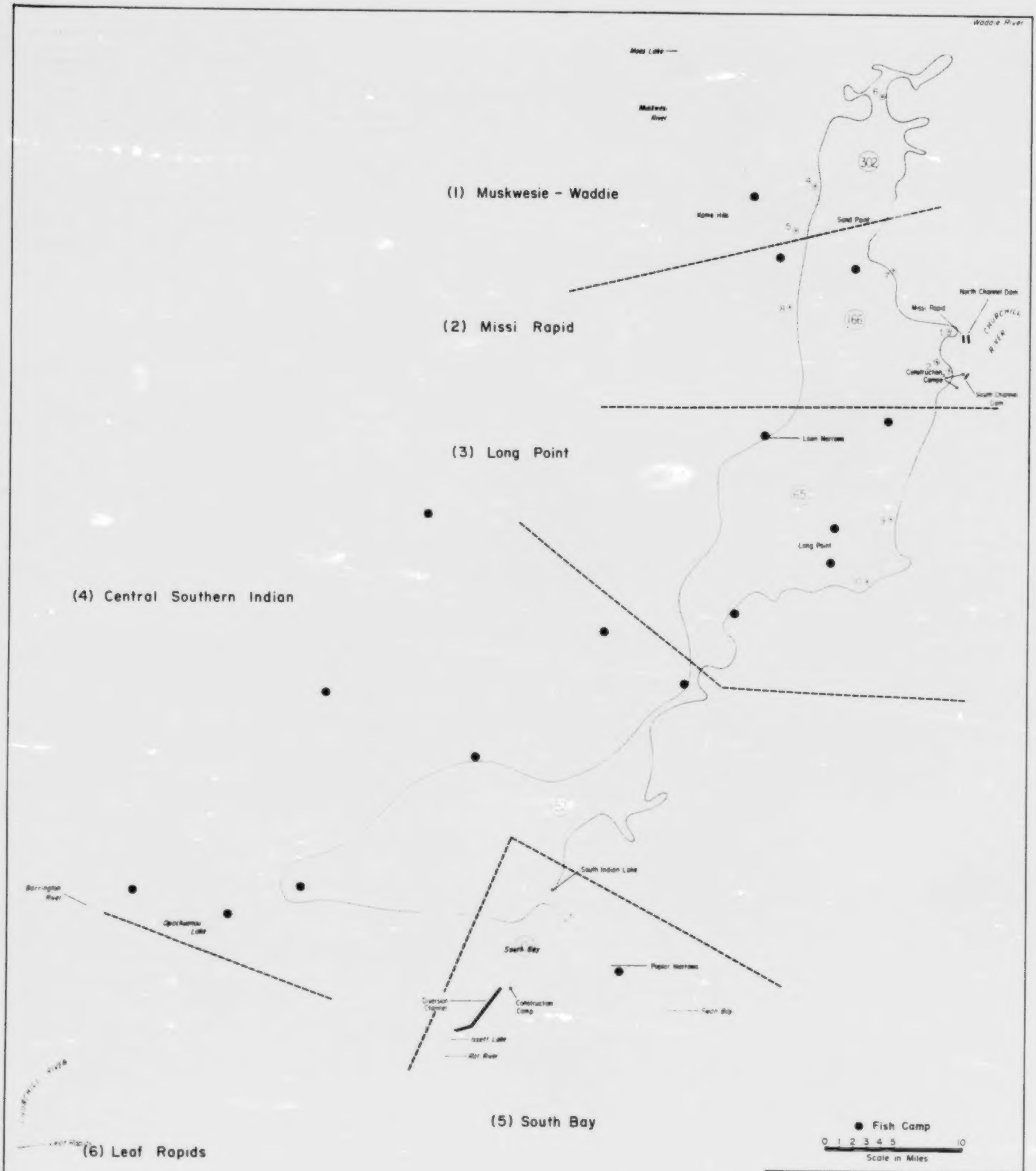
FIELD ACTIVITIES ON SOUTHERN INDIAN LAKE, 1973

Date	Method	Information Obtained	Section Surveyed
June 17	float plane	reconnaissance, shoreline waterfowl survey	1 (east side only) 2,3,4 (main body of lake)
June 22-25	boat	shoreline waterfowl survey	2 (Missi Rapid area)
June 26-29	boat	shoreline waterfowl survey	1 (west side, up to Moss Lake)
June 23, 28	boat	inspection of gull and tern nesting colonies	1 (near Long Point), 2 (Missi Rapid area)
July 28	float plane	reconnaissance, waterfowl broods	1, 2 (Missi Rapid area)
Sept. 1	float plane	moose browse survey, plots	parts of 1, 2, 6
Sept. 6	float plane	waterfowl staging survey	1, 2, 3 (east shore), 4 (east shore), 5
Sept. 27	float plane	waterfowl staging survey	1, 2, 3 (east shore), 4 (east shore), 5

APPENDIX 2

WATERFOWL SURVEY FLIGHT DATA 1973

	June 17	September 6	September 27
Time of Survey	1200 - 1400	1015 - 1415	1020 - 1335
Cloud Cover	90%	20%	20%
Temperature	55° F.	55° F.	50° F.
Wind	10 mph	20 mph	15 mph
Precipitation	nil	nil	nil
Air Speed	95 mph	90 mph	90 mph
Altitude	100 - 250 ft.	100 - 300 ft.	100 - 200 ft.
Aircraft	Beaver	Cessna 180	Cessna 180


Waddie River
Moss Lake
Muskwesie River
(1) Muskwesie - Waddie
302
Kame Hills
Sand Point
(2) Missi Rapid
166
North Channel Dam
Missi Rapid
CHURCHILL RIVER
Construction Camps
South Channel Dam
(3) Long Point
Loon Narrows
65
Long Point
(4) Central Southern Indian
South Indian Lake
Barrington River
Opachuanau Lake
South Bay
Poplar Narrows
Diversion Channel
Construction Camp
Issett Lake
Rat River
Swan Bay
CHURCHILL RIVER
Leaf Rapids
(5) South Bay
(6) Leaf Rapids
● Fish Camp
0 1 2 3 4 5 10
Scale in Miles

APPENDIX 3

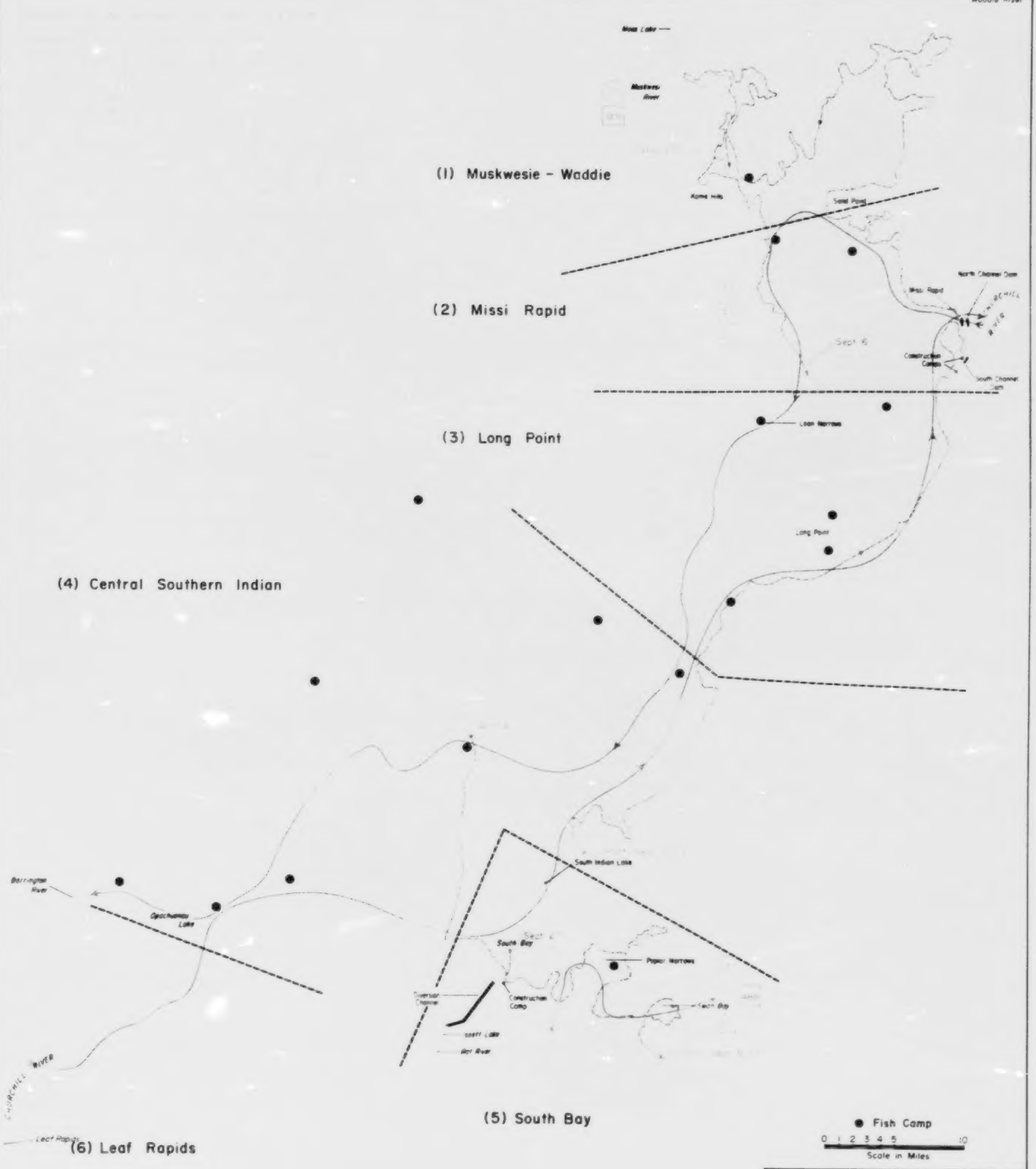
SPRING WATERFOWL SURVEYS

SOUTHERN INDIAN LAKE - MANITOBA

LAKE WINNIPEG,
CHURCHILL AND NELSON RIVERS
STUDY BOARD
WINNIPEG MANITOBA

PROJECT NO M 25

F.F. SLANEY & COMPANY LIMITED
Environmental Resource Consultants


Waddie River
Moss Lake
Muskwesi River
(1) Muskwesie - Waddie
Kame Hills
Sand Point
(2) Missi Rapid
North Channel Dam
Missi Rapid
CHURCHILL RIVER
Sept 6
Construction Camps
South Channel Dam
(3) Long Point
Loon Narrows
Long Point
(4) Central Southern Indian
South Indian Lake
South Bay
Diversion Channel
Construction Camp
Poplar Narrows
Scott Lake
Rat River
Barrington River
Opachuanau Lake
CHURCHILL RIVER
Leaf Rapids
(5) South Bay
(6) Leaf Rapids
● Fish Camp
0 1 2 3 4 5 10
Scale in Miles

APPENDIX 4

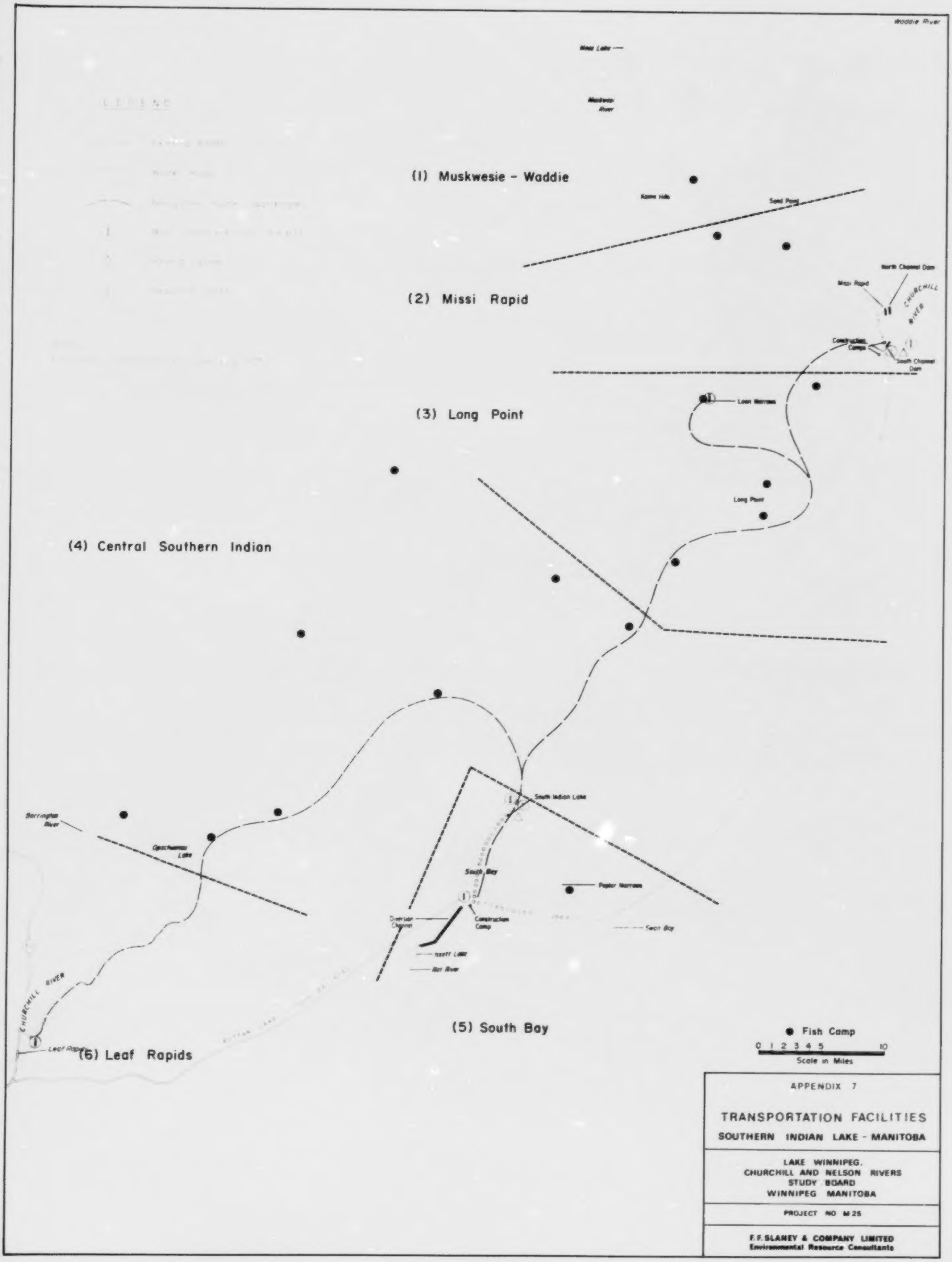
WATERFOWL STAGING SURVEYS

SOUTHERN INDIAN LAKE - MANITOBA

LAKE WINNIPEG.
CHURCHILL AND NELSON RIVERS
STUDY BOARD
WINNIPEG MANITOBA

PROJECT NO M 25

F. F. SLANEY & COMPANY LIMITED
Environmental Resource Consultants


Waddie River
Moss Lake
Muskwesie River
LEGEND
Existing Road
Winter Road
Navigation Route (approximate)
(1) Muskwesie - Waddie
Kame Hills
Sand Point
(2) Missi Rapid
North Channel Dam
Missi Rapid
CHURCHILL RIVER
Construction Camps
South Channel Dam
Loon Narrows
(3) Long Point
Long Point
(4) Central Southern Indian
South Indian Lake
Barrington River
Opachuanau Lake
South Bay
Poplar Narrows
Diversion Channel
Construction Camp
Swan Bay
Issett Lake
Rat River
CHURCHILL RIVER
Leaf Rapids
(6) Leaf Rapids
(5) South Bay
● Fish Camp
0 1 2 3 4 5 10
Scale in Miles

APPENDIX 7

TRANSPORTATION FACILITIES
SOUTHERN INDIAN LAKE - MANITOBA

LAKE WINNIPEG,
CHURCHILL AND NELSON RIVERS
STUDY BOARD
WINNIPEG MANITOBA

PROJECT NO M 25

F. F. SLANEY & COMPANY LIMITED
Environmental Resource Consultants

APPENDIX 8

AVERAGE PELT VALUES* - MANITOBA
1967/68 - 1971/72

YEAR	BEAVER	ERMINE	CROSS FOX	RED FOX	SILVER FOX	LYNX
1967/68	18.00	1.48	9.83	8.08	14.66	32.66
1968/69	22.00	2.43	16.50	14.50	18.00	41.00
1969/70	19.00	.98	18.00	10.00	12.00	30.00
1970/71	14.09	.52	21.90	12.40	10.00	29.50
1971/72	18.18	.74	19.98	15.15	12.00	39.31

YEAR	MARTEN	MINK	MUSKRAT	OTTER	SQUIRREL	WOLVERINE
1967/68	7.66	16.00	1.01	19.00	.51	26.00
1968/69	9.75	17.00	1.55	32.50	.40	52.50
1969/70	10.00	13.00	1.45	33.00	.25	57.00
1970/71	8.15	11.20	1.57	31.50	.25	70.40
1971/72	8.46	19.32	2.01	37.62	.52	84.65

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* Average values per pelt (R. Burns pers. comm.)
(Used for calculations in Appendices 9 - 13 and Tables 5 and 6).

APPENDIX 9

FUR HARVEST, SOUTHERN INDIAN LAKE REGISTERED TRAPLINE SECTION, 1967-68**

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
1*	1	59	1,062	5	163	21	336	62	62	47	1,670
2*	2	33	594	5	163	10	160	98	99	43	1,059
4*	3	137	2,466	1	32	6	96	597	603	168	3,365
5*	2	40	720	8	261	3	48	240	242	64	1,335
7	3	34	612	4	130	28	448	20	20	83	1,293
8	2	-	-	1	32	12	192	-	-	37	261
9*	1	-	-	1	32	-	-	-	-	-	32
11	1	15	270	-	-	10	160	68	68	54	552
12	1	90	1,620	2	65	22	352	68	68	159	2,264
13	4	140	2,520	2	65	9	144	166	167	66	2,962
17	1	-	-	-	-	8	128	-	-	19	147
18*	1	9	162	-	-	13	208	65	65	-	435
20	1	-	-	-	-	-	-	26	26	-	26
22*	3	78	1,404	-	-	-	-	414	418	38	1,860
23*	1	2	36	-	-	-	-	25	25	-	61
24*	4	63	1,134	2	65	10	160	289	292	117	1,768
25*	1	17	306	-	-	2	32	42	42	31	411
28	1	-	-	-	-	1	16	30	30	7	53
29*	1	27	486	1	32	9	144	55	55	49	766
31	3	22	396	1	32	18	288	104	105	38	859

APPENDIX 9 - (CONT'D)

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
32	1	-	-	-	-	14	224	-	-	-	224
33*	3	44	792	-	-	12	192	139	146	63	1,193
34*	4	111	1,998	8	261	104	1,664	201	203	190	4,316
35*	3	39	702	-	-	6	96	334	337	21	1,156
36	3	4	72	-	-	10	160	33	33	10	275
38	2	45	810	-	-	29	464	68	68	124	1,478
42	1	56	1,008	-	-	2	32	227	229	45	1,314
45	1	12	216	-	-	4	64	-	-	63	343
46	1	7	126	-	-	10	160	-	-	28	314
52*	1	-	-	-	-	7	112	-	-	3	115
54*	7	277	4,986	15	490	108	1,728	833	841	1,045	9,090
Totals	64	1,361	24,498	56	1,829	494	7,904	3,954	3,993	2,612	40,997

Total Active RTL's - 31

*Traplines affected by flooding

**Values calculated from Appendix 8, using fur harvest data from DMREM, The Pas.

APPENDIX 10

FUR HARVEST, SOUTHERN INDIAN LAKE REGISTERED TRAPLINE SECTION, 1968-69**

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
1*	3	63	1,386	6	246	44	748	29	45	-	2,425
2*	2	97	2,134	16	656	45	765	248	384	244	4,183
3	2	99	2,178	5	205	8	136	252	390	7	2,916
4*	5	138	2,036	18	738	20	340	647	1,003	69	4,186
5*	3	35	770	5	205	15	255	81	125	149	1,504
7	5	79	1,738	5	205	23	391	133	206	72	2,612
8	2	50	1,100	6	246	18	306	72	111	41	1,804
9*	1	17	374	-	-	-	-	77	119	-	493
11	1	18	396	1	41	17	289	3	4	215	945
12	1	64	1,408	4	164	62	1,054	43	66	466	3,158
13	1	-	-	-	-	1	17	-	-	-	17
14	1	-	-	-	-	59	1,003	-	-	227	1,230
17	2	22	484	-	-	3	51	69	107	10	652
18*	1	2	44	-	-	-	-	50	77	-	121
19*	1	4	88	3	123	-	-	-	-	-	211
22*	2	43	946	1	41	22	374	151	234	216	1,811
23*	1	10	220	-	-	-	-	17	26	32	278
24*	1	11	242	1	41	11	187	-	-	75	545
25*	1	8	176	-	-	-	-	-	-	-	176
27	1	2	44	-	-	-	-	-	-	-	44

APPENDIX 10 - (CONT'D)

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
28	4	55	1,210	-	-	2	34	220	341	32	1,617
29*	4	54	1,188	-	-	7	119	159	246	65	1,681
30	1	31	682	-	-	1	17	32	49	32	780
31	5	44	968	6	246	31	527	78	121	161	2,023
32	1	17	374	1	41	8	136	39	60	34	645
33*	4	49	1,078	5	205	37	629	75	116	79	2,107
34*	2	41	902	2	82	39	663	-	-	7	1,654
35*	3	37	814	1	41	16	272	88	136	75	1,338
36	1	16	352	-	-	2	34	42	65	-	451
38	2	16	352	-	-	18	306	17	26	147	831
39	1	12	264	-	-	4	68	12	18	32	382
42	1	-	-	-	-	1	17	2	3	-	20
45	2	10	220	-	-	13	221	-	-	32	473
47	1	5	110	-	-	14	238	-	-	48	396
49	1	2	44	-	-	-	-	-	-	1	45
50	2	7	154	-	-	22	374	-	-	66	594
51	2	13	286	3	123	11	187	24	37	17	650
54 *	16	16	352	-	-	16	272	33	51	337	1,012
Totals	90	1,187	26,114	89	3,649	590	10,030	2,693	4,174	2,993	46,010

Total Active RTL's - 38

*Traplines affected by flooding

**Values calculated from Appendix 8, using fur harvest data from DMREM, The Pas.

APPENDIX 11

FUR HARVEST, SOUTHERN INDIAN LAKE REGISTERED TRAPLINE SECTION, 1969-70 **

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
1*	2	89	1,691	12	360	36	468	58	84	98	2,701
2*	1	33	627	19	570	22	286	148	214	69	1,766
3	1	19	361	5	150	4	52	-	-	33	596
4*	6	87	1,653	56	1,680	26	338	458	664	431	4,766
5*	3	46	874	13	390	3	39	186	269	176	1,748
6*	1	33	627	6	180	16	208	-	-	10	1,025
7	3	45	855	21	630	7	91	214	310	34	1,920
8	2	18	342	2	60	20	260	41	59	43	764
9*	2	26	494	11	330	5	65	91	132	76	1,097
10*	1	27	513	-	-	-	-	26	37	-	550
11	1	6	114	-	-	9	117	-	-	33	264
13	2	36	684	2	60	23	299	-	-	147	1,190
14	1	1	19	-	-	6	78	-	-	43	140
17	1	4	76	-	-	1	13	26	37	3	129
20	1	20	380	-	-	-	-	-	-	202	582
22*	2	28	532	1	30	7	91	21	30	36	719
23*	1	13	247	2	60	2	26	-	-	113	446
24*	5	57	1,083	12	360	11	143	96	139	203	1,928
25*	1	7	133	1	30	-	-	-	-	35	198

APPENDIX 11 - (CONT'D)

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
27	1	5	95	-	-	-	-	-	-	10	105
28	1	24	456	-	-	3	39	9	13	-	508
29*	2	12	228	3	90	7	91	26	37	143	589
30	2	17	323	4	120	12	156	65	94	53	746
31	5	24	456	18	540	10	130	-	-	10	1,136
32	1	24	456	4	120	12	156	-	-	10	742
33*	4	35	665	16	480	25	325	117	169	304	1,943
34*	2	49	931	12	360	11	143	71	103	-	1,537
35*	4	13	247	19	570	10	130	53	77	28	1,052
36	1	7	133	4	120	2	26	-	-	10	289
37	1	17	323	-	-	5	65	13	19	133	540
38	4	21	399	-	-	11	143	12	17	429	988
39	2	18	342	-	-	1	13	6	8	10	373
42	1	13	247	-	-	3	39	-	-	6	292
45	1	27	513	2	60	6	78	-	-	28	679
46	1	16	304	-	-	-	-	22	32	-	336
47	2	5	95	-	-	5	65	-	-	-	340
49	1	6	114	-	-	-	-	-	-	-	114
50	1	10	190	1	30	9	117	-	-	90	427
51	2	16	304	4	120	5	65	33	48	-	537
52*	1	33	627	1	30	3	39	-	-	10	706

APPENDIX 11 - (CONT'D)

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
53	1	6	114	1	30	2	26	46	66	-	236
54*	9	17	323	2	60	8	104	42	61	47	595
Totals	87	1,010	19,190	254	7,620	349	4,537	1,880	2,726	3,106	37,339

Total Active RTL's - 42

*Traplines affected by flooding

**Values calculated from Appendix 8, using fur harvest data from DMREM, The Pas.

APPENDIX 12

FUR HARVEST, SOUTHERN INDIAN LAKE REGISTERED TRAPLINE SECTION, 1970-71 **

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
1*	1	38	535	1	29	14	157	16	25	70	816
2*	1	85	1,197	-	-	22	246	180	282	149	1,874
3	2	61	859	2	59	2	22	29	45	25	1,010
4*	4	93	1,310	40	1,180	16	179	456	716	163	3,548
5*	2	25	352	8	236	-	-	26	41	31	660
6*	1	41	577	2	59	8	89	20	31	-	756
7	1	1	14	10	295	2	22	-	-	70	401
8	2	48	676	5	147	6	67	135	212	43	1,145
9*	2	11	155	8	236	2	22	25	39	107	559
10*	1	-	-	-	-	-	-	-	-	31	31
12	3	66	930	-	-	3	33	-	-	35	998
13	2	41	577	-	-	5	56	-	-	69	702
14	1	-	-	-	-	3	33	-	-	31	64
16	1	-	-	-	-	6	67	-	-	-	67
22*	2	19	267	5	147	7	78	73	114	95	701
23*	1	1	14	-	-	2	22	-	-	54	90
24*	4	51	718	12	354	3	33	80	125	303	1,533
25*	1	2	28	-	-	-	-	100	157	-	185
27	1	10	141	-	-	1	11	-	-	4	156
28	3	54	761	-	-	1	11	39	61	134	967

APPENDIX 12 - (CONT'D)

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
29*	2	36	507	1	29	4	45	56	88	10	679
30	2	25	352	-	-	-	-	27	42	8	402
31	3	46	648	7	206	10	112	117	183	71	1,220
32	1	21	296	2	59	5	56	-	-	53	464
33*	4	71	1,000	14	413	10	112	91	143	16	1,684
34*	2	87	1,226	20	590	12	134	45	70	53	2,073
35*	3	36	507	3	88	1	11	67	105	8	719
36	2	30	422	6	177	10	112	26	41	-	752
37	1	9	127	-	-	-	-	-	-	12	139
38	4	41	577	1	29	3	33	3	5	37	681
39	1	12	169	-	-	-	-	36	56	8	233
40	2	50	704	-	-	5	56	43	67	31	858
42	2	38	535	1	29	3	33	14	22	22	641
43*	4	27	380	9	265	3	33	40	63	1	742
44	2	9	127	-	-	7	78	59	92	8	305
45	1	45	634	-	-	10	112	3	5	-	751
46	1	37	521	1	29	6	67	2	3	63	683
47	2	8	112	-	-	-	-	58	91	31	257
49	1	3	42	-	-	-	-	-	-	-	42
50	2	28	394	3	88	7	78	-	-	126	686

APPENDIX 12 - (CONT'D)

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
51	2	53	746	2	59	5	56	57	89	31	981
53	1	17	239	-	-	-	-	42	66	1	306
54*	10	48	676	5	147	3	33	196	307	46	1,209
Totals	91	1,424	20,064	168	4,956	201	2,251	2,161	3,392	2,050	32,770

Total Active RTL's - 43

*Traplines affected by flooding

**Values calculated from Appendix 8, using fur harvest data from DMREM, The Pas.

APPENDIX 13

FUR HARVEST, SOUTHERN INDIAN LAKE REGISTERED TRAPLINE SECTION, 1971-72**

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
1*	2	44	800	15	589	15	290	15	30	162	1,871
2*	2	28	509	29	1,140	17	328	-	-	275	2,253
3	1	34	618	5	196	6	116	4	8	102	1,040
4*	5	40	727	14	550	3	58	169	339	98	1,772
5*	2	7	127	6	236	-	-	36	72	-	435
6*	2	22	400	-	-	1	19	-	-	-	419
7	2	6	109	11	432	1	19	14	28	16	604
8	1	2	36	1	39	-	-	-	-	37	112
9*	2	10	182	16	629	3	58	92	185	125	1,179
10*	2	2	36	-	-	-	-	-	-	-	36
12	1	46	836	-	-	2	38	52	104	414	1,392
13	1	70	1,272	1	39	-	-	33	66	138	1,515
16	1	10	182	2	78	-	-	-	-	15	275
22*	1	-	-	-	-	8	154	2	4	15	173
23*	1	9	163	-	-	-	-	-	-	8	171
25*	1	18	327	1	39	9	174	78	157	98	795
28	3	39	709	4	157	1	19	2	4	154	1,043
29*	1	8	145	2	78	1	19	-	-	-	242
30	2	17	309	-	-	2	38	84	169	44	560

APPENDIX 13 - (CONT'D)

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
31	3	35	636	9	353	2	38	3	6	99	1,132
32	1	3	54	-	-	-	-	6	12	-	66
33*	5	65	1,181	15	589	3	58	127	255	205	2,288
34*	3	25	454	13	511	6	116	27	54	12	1,147
35*	2	20	363	7	275	4	77	52	104	201	1,020
36	2	26	472	3	118	2	38	9	18	52	698
37	1	13	236	-	-	-	-	8	16	-	252
38	1	-	-	-	-	3	58	-	-	45	103
39	1	2	36	-	-	1	19	2	4	8	67
40	1	28	509	3	118	-	-	23	46	75	748
41	1	12	218	-	-	8	154	19	38	354	764
42	2	4	73	-	-	1	19	21	42	-	134
43*	3	22	400	20	786	3	58	254	510	107	1,861
44	1	5	91	-	-	-	-	-	-	76	167
45	1	17	309	-	-	-	-	56	112	113	534
50	2	26	472	-	-	-	-	-	-	150	622
51	1	12	218	5	196	1	19	45	90	-	523
52*	1	10	182	-	-	2	38	3	6	37	263

APPENDIX 13 - (CONT'D)

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
53	2	1	18	3	181	-	-	9	18	35	252
54*	10	8	145	1	39	4	77	125	251	58	570
Totals	77	747	13,580	186	7,311	109	2,106	1,370	2,753	3,328	29,098

Total Active RTL's - 39

*Traplines affected by flooding

**Values calculated from Appendix 8, using fur harvest data from DMREM, The Pas.

APPENDIX 14

THE HYDROELECTRIC PROJECT

INTRODUCTION

Manitoba Hydro, a crown corporation, is charged with providing electrical service to the people and industry of Manitoba. Historically, accessible large rivers have provided sufficient economical hydroelectric energy to meet this need. Rapidly increasing energy demands have necessitated the continuing development of new and larger generating facilities. Economic conditions, uncertain supply of fossil fuels, imperfect nuclear generation techniques and the obvious potential of Manitoba's northern rivers contributed to the decision to construct hydroelectric generation facilities on the Nelson River. Two assumptions, based on geographical conditions, were made to maximize the benefits of these facilities. Firstly, the natural storage potential of Lake Winnipeg could be used to regulate the flows of the Nelson River and secondly, the most economical method of extracting the energy of the Churchill River would be to divert a large portion of its flow through the Nelson River generating stations.

This report describes the engineering works which facilitate the Churchill River diversion and outlines the initial physical impacts of this project.

PART 1

THE ENGINEERING WORKS

The diversion of the Churchill River into the Nelson River required the construction of two facilities, an obstruction in the Churchill River's natural channel, and an outlet into the Nelson River drainage (Map 1). A coincidence of nature provided excellent locations for both structures on Southern Indian Lake. Four potential sites for hydroelectric generating stations have also been identified along the diversion route.

1.1 SOUTHERN INDIAN LAKE AREA STRUCTURES

Two major diversion elements were constructed on Southern Indian Lake, a widening of the Churchill River. Topography and location made the diversion scheme more feasible because the Lake is a natural storage reservoir.

1.1.1 Missi Rapid Dams and Spillway

Missi Rapid is the natural outlet of the Churchill River from Southern Indian Lake into Partridge Breast Lake. The northernmost of its two channels carries most of the outflow through a spectacular waterfall-rapid. This channel will be blocked with two earth and rock-fill dams 800 feet in length (Manitoba Hydro 1973). The south channel will also be closed with a similar 1200 foot structure. A spillway channel will be constructed through the southern end of the island separating the two original channels. The new channel will be approximately 2000 feet long and 315 feet in width. Flow through the channel will be regulated by six lift gates (Manitoba Hydro 1972). Earth and rock-fill dykes will be constructed on the island between the dams to contain future raised lake levels.

The south channel was closed in the fall of 1973 and impoundment of Southern Indian Lake will commence with the closing of the Missi Rapid channel in 1975. All construction at Missi will be completed by January 1976.

1.1.2 South Bay Channel

Alternative methods of releasing the Churchill River flows into the Nelson River were evaluated. Economic considerations showed the best method to be construction of a channel from South Bay of Southern Indian Lake to Issett Lake, the headwaters of the Rat River, a tributary of the Nelson River (Manitoba Hydro 1970). This excavated channel will be 5.7 miles long and will vary in width from 110 feet to 300 feet. It will be constructed through muskeg, rock and overburden and will generally follow the course of two small streams. The channel is designed to carry 30,000 cfs flow under all weather conditions. Completion date is set for November 1, 1975.

1.1.3 Construction Camps and Transportation Facilities

The diversion elements will be constructed independently. Missi Rapid camp is located on the mainland south of the rapid and will contain 400 men when fully operational in the fall of 1975 (Manitoba Hydro 1973). The camp is serviced by tug and barge from South Bay and Leaf Rapids and by scheduled aircraft flights to the camp's permanent gravel air strip. The construction and clearing camp for the South Bay channel is located on South Bay near the channel entrance. This camp will house 300 men during peak construction periods and will be dismantled upon completion of the channel. An all weather road connects the camp with Highway 391 and thereby to all land transport services. A gravel air strip has been constructed by Manitoba Hydro for emergency service. Docking facilities for the barges to and from Leaf Rapid and Missi camps are also located here (Appendix 7).

The community of South Indian Lake is serviced by schedule flights to a 2000 foot gravel air strip and chartered flights to the seaplane base, both near the community. The South Indian Lake Fisheries Cooperative also runs boat service throughout the Lake during the summer. Float-plane traffic is common in the Southern Indian Lake area during summer months. Local winter transportation is usually by Bombardier and snowmobile, but the South Indian community and construction camps are accessible over winter roads by truck and tractor train (Rosin, Saccomanno, and Trachtenberg 1973).

1.2 DIVERSION ROUTE STRUCTURES

The water diverted from the Churchill River will flow down the channels of the Rat and Burntwood Rivers entering the Nelson River at Split Lake. Along this route Manitoba Hydro proposes to place four structures including a control dam and generating station below Notigi Lake. Generating stations are planned for Taskinigup Rapids below Wuskwatim Lake, at Manasan Falls, and at the first rapids above Split Lake.

PART 2

IMPACTS

The aim and results of the engineering works associated with Churchill River diversion will be altered lake levels and river flows. The initial impacts of construction activities, reservoir formation, and diversion will be followed by the long term impact of the new water regimes and associated natural process. These deviations from historic conditions are described in order that more subtle environmental impacts may also be identified.

2.1 SOUTHERN INDIAN LAKE AREA IMPACTS

A significant permanent increase in the level of Southern Indian Lake is a major feature of the diversion scheme (Fig. 1). The flow path of the Churchill River through the Lake will change and new seasonal lake level fluctuations will occur. Increased human activity and new service facilities will also influence the environment of the Lake and surrounding area.

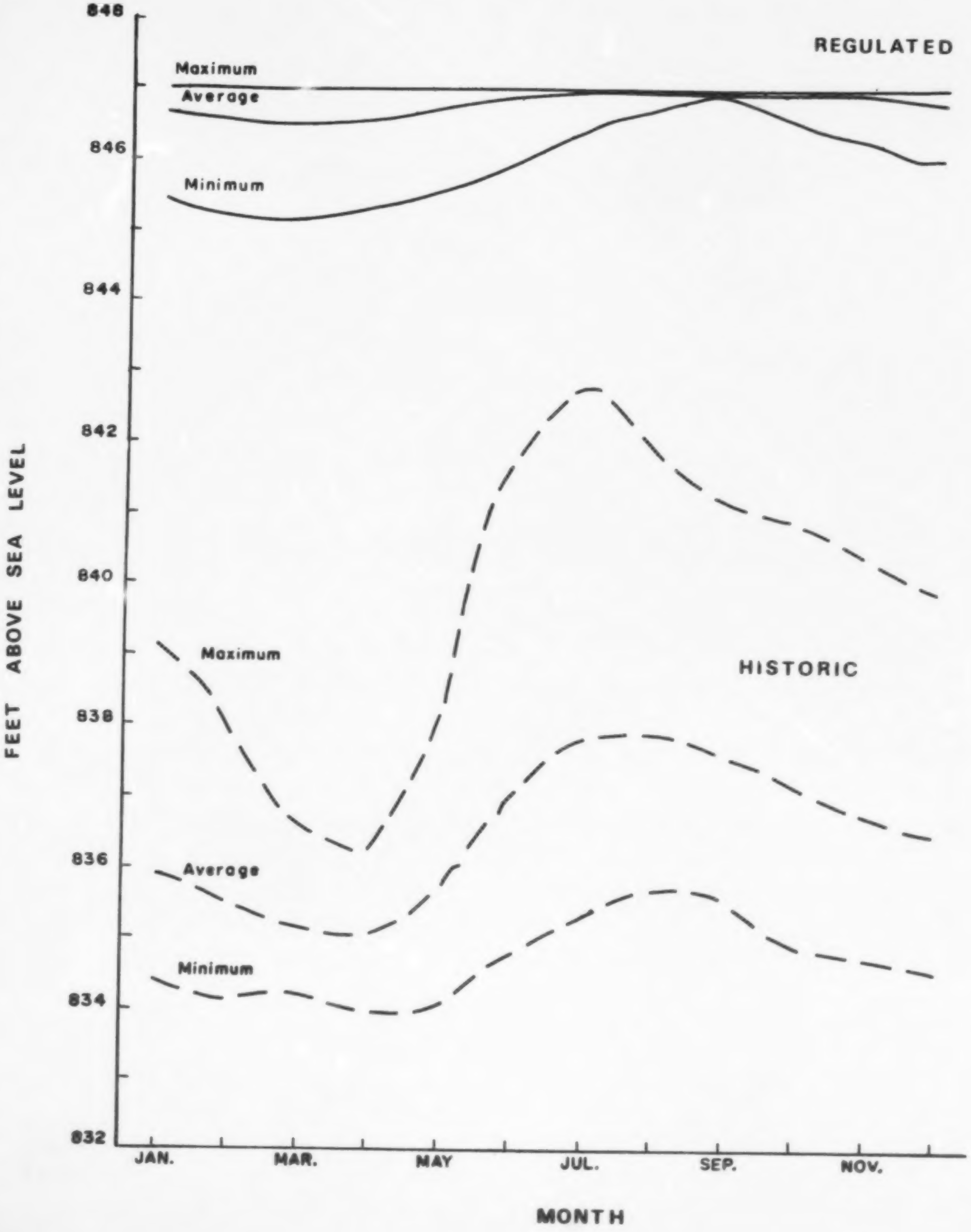
2.1.1 Southern Indian Lake

The average level of Southern Indian Lake will be increased by 10 feet to a maximum elevation of 850 feet and an average elevation of 847 feet (Manitoba Hydro 1970). The new lake levels will be achieved by impounding inflow of the Churchill River in 1975. Impoundment could begin as early as February or as late as June. Maximum monthly increases of 1.9 feet and 1.8 feet are expected in June and July. The new final levels are expected to flood a total of 135,534 acres around Southern Indian, Opachauanau, and Granville Lakes (Flanders, Lamont and Kaye 1973). The flooded area is presently 60% productive forest and 40% non-productive or non-forested.

FIGURE 1

HISTORIC AND REGULATED MEAN MONTHLY WATER LEVELS SOUTHERN INDIAN LAKE, MANITOBA

(SOURCE: D.M.R.E.M. 1973b)



Historically, Southern Indian Lake has had average annual level fluctuations of 2.75 feet with maximum fluctuations of 6.5 feet. The diversion scheme will reduce annual fluctuations to an average of 0.5 feet and a maximum 2.0 feet. Seasonal lake levels will continue to rise and fall in a pattern similar to historic conditions (Fig. 1).

New shorelines may take some years to become established and floating debris from flooded lands will persist during the stabilization process; however, booms will be installed to contain floating debris in designated areas. Flooded islands may become navigational hazards unless properly marked.

Currents in the lake are expected to change as a result of the relocation of the main river outlet to South Bay. These new currents will alter the ice formation sequence on the Lake and may produce precarious winter ice conditions in some areas.

2.1.2 Missi Rapid

Blockage of the two natural outflow channels and the introduction of a controlled spillway are immediate impacts at Missi Rapid. The rapids will be eliminated and the reduced outflow will leave the lake through the spillway. The mean monthly average annual outflow will be reduced from 35,692 cfs to 8,857 cfs. With the diversion scheme, however, mean monthly outflows could be as low as 500 cfs and as high as 73,787 cfs. In general, flows will be much lower than recorded historic flows.

Ice formation above Missi Rapid will become more extensive as the flows will not be sufficient to maintain large areas of open water above the spillway.

The Missi Rapid area will also experience impacts as a result of construction facilities such as roads, excavations, fuel storage, maintenance services, and construction camp. Human utilization of the area's resources will be highest during the construction period but the permanent air strip will provide access for future visitors.

2.1.3 South Bay Channel

The new major outlet for Churchill River water from Southern Indian Lake will be the channel from South Bay to Issett Lake. Maximum flows through the channel will be 30,000 cfs. Average mean monthly flows are expected to range from 24,750 cfs. to 29,390 cfs. While the channel will ensure a reliable flow under all conditions it will not completely contain the outflow water. The diversion route reservoir level will cause some 3,000 acres of land to be flooded around the lower portion of the channel at Issett Lake (Whiddon, Lamont and Kaye 1973). Controlled releases through this channel in fall 1977 will equalize the levels of Notigi reservoir and Southern Indian Lake.

Construction activities such as excavation and clearing will result in impacts along the channel route. The South Bay camp also serves as a transfer point for materials to be shipped by barge to the Missi Camp. Spillage and activity around the dock area will affect local water quality during the operational period. The construction camp and personnel will also have an impact on the immediate area. The all weather road from Ruttan Lake, Leaf Rapids and PR 391 to the channel will provide access for non-residents during construction and after completion.

2.2 DIVERSION ROUTE IMPACTS

Major impacts along the diversion route will result from greatly increased flows, newly formed reservoirs and construction and clearing activities associated with the projects. Variable discharges of water and fluctuating reservoir levels may occur as the hydroelectric generation facilities are manipulated to meet power demands.

2.3 LOWER CHURCHILL RIVER IMPACTS

Impacts along the Churchill River below Missi Rapid will occur as a result of greatly decreased average flows. The timing and magnitude of seasonal fluctuations will deviate from historic conditions and this will have both immediate and long term impacts. Under regulation the yearly average discharge of the Churchill River below Missi Rapid will be reduced by approximately 75%. However, under extreme conditions the monthly flows could be as little as 4% of historic or as much as the highest historic flows (Fig. 1). There is high probability of severe fluctuations in flow during summer months, as illustrated below:

SUMMER OUTFLOW FLUCTUATIONS AT MISSI RAPID

Flow Change in cfs	MAY		JUNE		JULY		AUGUST		SEPTEMBER	
	Rise	Drop	Rise	Drop	Rise	Drop	Rise	Drop	Rise	Drop
0-5,000	10%	49%	16%	4%	19%	19%	24%	35%	1%	33%
5,000-10,000	6%		10%		9%	19%	3%	18%	5%	33%
10,000-20,000	16%		43%			28%	2%	18%		26%
20,000-30,000	15%		17%			5%				0
30,000-40,000	2%		4%							2%
40,000- +	2%		6%							

Winter flow fluctuations will be more moderate with a general decrease in discharge from October at 8,500 cfs to March at 1,500 cfs.

These low flows will result in reduced levels of the lakes below Missi Rapid and may build up extensive ice formation in the Lower Churchill River (Newbury 1970).

APPENDIX 15

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WILDLIFE RESOURCE IMPACT ASSESSMENT - LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS HYDROELECTRIC PROJECTS

NO. 3 - LAKE WINNIPEG, LOWER CHURCHILL RIVER, RAT-BURNTWOOD DIVERSION

WILDLIFE RESOURCE IMPACT ASSESSMENT LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS HYDROELECTRIC PROJECTS

NO. 3 - LAKE WINNIPEG, LOWER CHURCHILL RIVER, RAT-BURNTWOOD DIVERSION

by

R. WEBB and J. FOSTER
F. F. Slaney & Company Limited
Vancouver, British Columbia
May, 1974

for

THE LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD

SPECIAL NOTE

THE CONCLUSIONS AND RECOMMENDATIONS CONTAINED IN THIS APPENDIX ARE THOSE OF THE AUTHOR(S) AND ARE NOT NECESSARILY THE SAME AS THE CONCLUSIONS AND RECOMMENDATIONS OF THE LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD AS EXPRESSED IN THE SUMMARY REPORT AND THE TECHNICAL REPORT.

F.F. SLANEY & COMPANY LIMITED

Telex 04-55287 • 402 West Pender St., Vancouver, Canada V6B 1T9 • Phone 687-0151

June 14, 1974

M.25

Mr. D. G. Ramsey
Study Director
Lake Winnipeg, Churchill and Nelson
Rivers Study Board
693 Taylor Building
WINNIPEG, Manitoba.

Dear Mr. Ramsey:

It is the pleasure of F. F. Slaney & Company to submit the Lake Winnipeg, Churchill River and Rat-Burntwood Diversion wildlife report, thus fulfilling our contract for wildlife assessment.

We have identified the major wildlife issues in the three Study Areas that are associated with Manitoba Hydro's development plans and have proposed for consideration ways of reducing the impact of detrimental effects.

Sincerely,

F. F. SLANEY & COMPANY LIMITED

R. Webb

R. Webb,
Project Director.

J. A Foster

J.A. Foster,
Project Manager.

encl.
RW/ldo

VANCOUVER ▲ SEATTLE ▲ EDMONTON ▲ TORONTO

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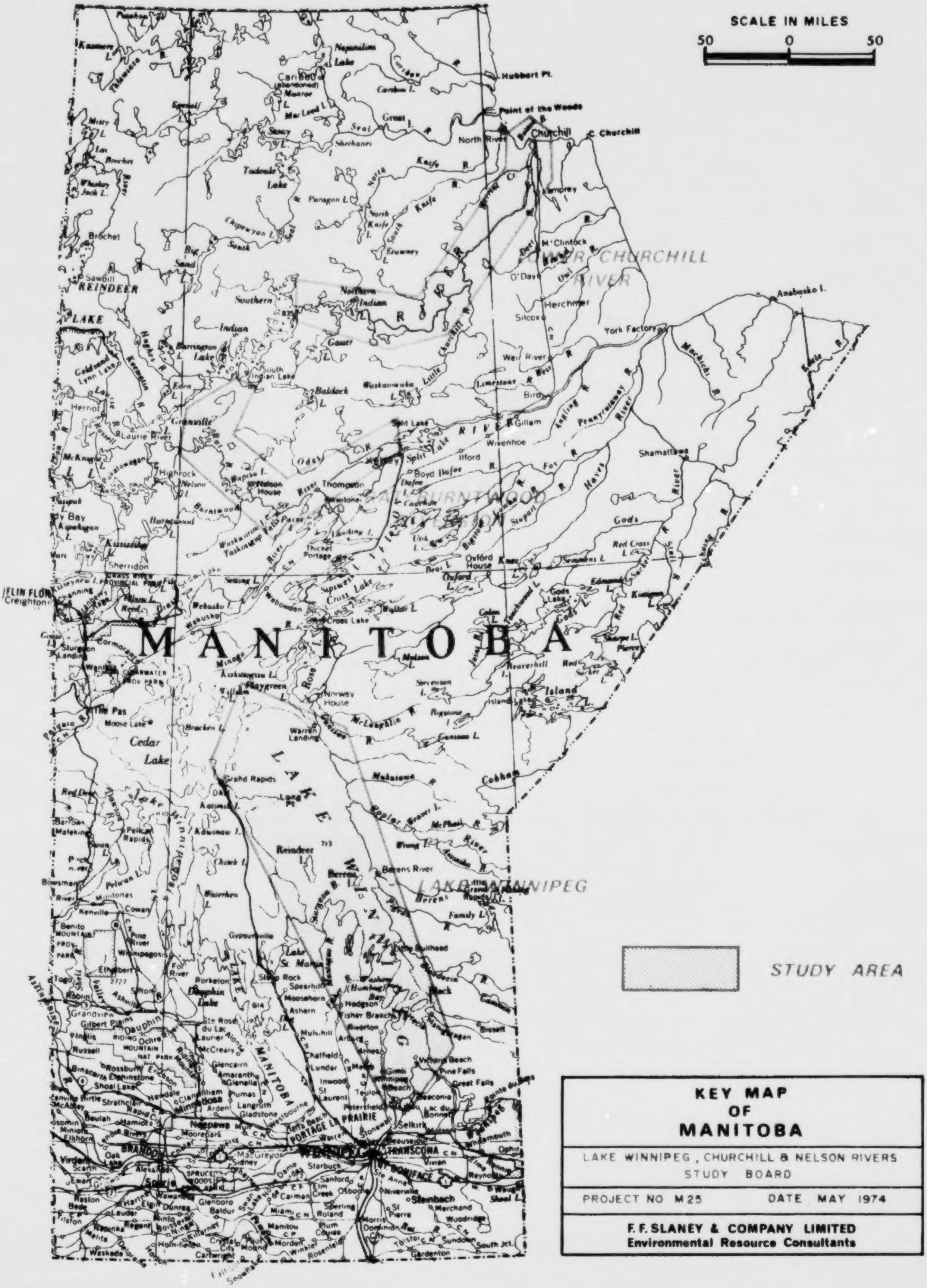
SCALE IN MILES
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50
STUDY AREA
MANITOBA
LOWER CHURCHILL RIVER
CHURCHILL
BURNTWOOD DIVERSION
LAKE WINNIPEG
Churchill
C. Churchill
Hubbart Pt.
Point of the Woods
North River
York Factory
Gillam
Split Lake
Thompson
Norway House
Grand Rapids
The Pas
Cedar Lake
Berens River
Lynn Lake
Sherridon
Flin Flon
Creighton
Sturgeon Landing
Dauphin
Brandon
Portage la Prairie
Winnipeg
Transcona
Selkirk
Steinbach
Souris
Virden
Lake Manitoba
Lake Winnipegosis
Reindeer Lake
South Indian Lake
Gods Lake
Island Lake
Oxford House
Cross Lake
Cobham
Shamattawa

KEY MAP
OF
MANITOBA

LAKE WINNIPEG, CHURCHILL & NELSON RIVERS
STUDY BOARD

PROJECT NO M25 DATE MAY 1974

F. F. SLANEY & COMPANY LIMITED
Environmental Resource Consultants

ABSTRACT

This report identifies and discusses major wildlife resources and potential issues associated with the hydro development on Lake Winnipeg, the lower Churchill River and the Rat-Burntwood Diversion.

Data were gathered on the wildlife of these areas from August 1972 to March 1974 through field surveys, personal communications and literature review.

Surface area of Lake Winnipeg is 9500 square miles. Marshes around the southern shores of the lake totalling over 150 square miles have been highly productive of waterfowl and furbearers. Muskrat populations are currently at a very low level (.05 per acre) in Netley-Libau marsh due to recent low summer water levels and damage to houses in fall by wind set-up. There were 20 pairs of breeding waterfowl per square mile (adjusted) in the major marshes in spring 1973. As many as 48,000 ducks may be present during peak periods in Netley-Libau in fall. White pelicans, double-crested cormorants, and several species of gulls and terns have colonies on the islands and reefs of the lake. Most important potential issues identified in the area were stagnation of marshes with higher, more stable levels and periodic loss of some smaller satellite islands used by colonial nesting birds.

The lower Churchill River has several rapids and four lakes throughout its length. Muskeg ponds are common in the backshore as the river approaches Hudson Bay. The area generally has low potential for productivity of moose. Returns from most of the registered traplines along the river are small. The river provides important rearing habitat for Canada geese, with its long stretches of ice-scoured shores offering grasses and sedges for food. Average annual flows will be reduced to 24% of normal, with significant reduction in lake surface areas. Most important potential issues identified in the area were delayed formation of shoreline ice at Cape Churchill lengthening the time polar bears spend on land around the townsite; loss of staging and rearing habitat for Canada geese with probable disappearance of ice-scouring effect; possible destruction of waterfowl nests in May and June when heavy flows are released; modification of estuarine community with increased penetration by sea water; and loss of trapping income.

The Rat and Burntwood Rivers have had mean annual flows of 1020 and 2980 cfs respectively. Nearly 30,000 cfs more will be sent down these channels after diversion. Moose populations along the entire Diversion Route are currently low, although densities are greater in the upper Rat and lower Burntwood Rivers. As many as 70-150 moose will be displaced with flooding behind Notigi, Wuskwatim, and Manasan. Effects on caribou will be minor. Sixty-three percent of the active trappers in the Nelson House Section will lose part of their traplines through flooding; thirty traplines will be affected. Beaver and muskrat reproductive potential will be lost. Value of the Diversion Route to waterfowl is generally low, although some marsh areas offer nesting and staging habitat. Major issues identified in the areas were loss of riparian wildlife habitat; loss of furbearers and destruction of habitat with flooding to 820 feet asl behind ice jams; loss of marsh habitat; length of time for re-establishment of productive habitat; collection of debris in bays with low shorelines by a booming process; loss of shoreline hunting opportunity by natives; conflict between sport and native hunting; harassment of wildlife during construction and clearing phases; and loss of income through trapping.

SUMMARY

RECOMMENDATIONS

Wildlife issues identified as most significant in the three areas studied were:

Lake Winnipeg

A. Stagnation of marshes with higher range of relatively stable water levels after regulation.

B. Loss of some of the smaller islands used by colonial nesting birds.

Lower Churchill River

A. Delayed formation of shoreline ice may lengthen time polar bears spend on land around Churchill.

B. Loss of staging and rearing habitat for Canada geese with probable disappearance of ice-scouring effect.

C. Possible destruction of waterfowl nests in May and June when heavy flows are released.

D. Modifications in the flora and fauna of the estuary with increased frequency of penetration by sea water.

E. Loss of income from trapping.

Rat-Burntwood Diversion

A. Loss of riparian shoreline habitat used by moose, furbearers, waterfowl and other species for food and cover.

B. Possible loss of furbearers and destruction of habitat with potential flooding to 820 feet above sea level or greater behind ice jams at Third Rapids.

C. Loss of marsh habitat in the upper Rat River and Wuskwatim Lake.

D. Length of time for re-establishment of suitable wildlife habitat.

SUMMARY (page 2)

E. Collection of debris in bays with low shorelines by a booming process.

F. Loss of shoreline hunting opportunity by natives.

G. Conflict between sport and native hunting.

H. Harassment of wildlife during construction and clearing phases.

I. Loss of income through trapping.

Recommended procedures for lessening impact upon wildlife:

Lake Winnipeg

1. Establishment of a Committee to co-ordinate managment and establish priorities for wildlife habitat improvement.
2. Consideration of marsh management techniques for Netley-Libau.
    - i. diking and pumping
    - ii. creation of islands
    - iii. pothole blasting and ditching
    - iv. planting of attractive food species
3. Management of specific areas for Canada geese.
4. Determination of optimal water regime in managed marshes to maximize furbearer and waterfowl production.

Lower Churchill River

1. Establishment of a system among all agencies concerned to monitor effects of regulation schemes on fisheries and wildlife.
2. Maintenance of sufficient flows in fall and winter to preserve ice-scouring effect along the river and encourage formation of local Hudson Bay land-fast ice.

SUMMARY (page 3)

3. If feasible, release more even flows in spring to prevent damage to waterfowl nests.
4. Consider the construction of weirs to maintain levels of Northern Indian and Fidler Lakes to allow more even releases downstream of these structures.
5. Consider compensation for loss of trapping income.

Rat-Burntwood Diversion

1. Consideration should be given to diking off certain areas which are currently productive to avoid loss through flooding.
2. If feasible, avoid raising water levels after freeze-up by more than one to two feet to prevent displacement of aquatic furbearers and prevent unsafe ice conditions for mammals.
3. Avoid raising water levels during May and June by more than one to two feet to eliminate destruction of waterfowl nests.
4. Clearing on an acre-for-acre basis should be carried out to replace prime wildlife habitat lost through flooding.
5. Potentially productive bays should not be used for booming.
6. Establishment of a game harvest control plan to regulate big game hunting by natives and sport hunting.
7. Avoid harassment of wildlife.
8. Nesting sites of eagles and ospreys should not be disturbed.
9. Consider compensation for loss of trapping income.

OBJECTIVES

The report identifies wildlife issues, assesses main effects on wildlife resources, and identifies mitigation possibilities for Lake Winnipeg, the Lower Churchill River and the Rat-Burntwood Diversion.

TERMS OF REFERENCE

F.F. Slaney & Company Limited began work on wildlife resource studies August 15, 1972. A full program of field study began in June, 1973. Reports on the impact of development on the Outlet Lakes and Southern Indian Lake were submitted in March, 1973 and March, 1974 respectively.

THE STUDY AREAS

Lake Winnipeg

The climate of southern Manitoba is moderated by Lakes Manitoba and Winnipeg. Average yearly mean temperature variations are from plus 64 to 66°F in July to minus 8 to 2°F in January, north to south. Frost free period is 100-120 days and annual precipitation is only 18-20 inches.

Geology of the area is complex, with Silurian, Ordovician and Precambrian formations present. Overall relief is very low, and muskeg is common on the eastern side.

Surface area of Lake Winnipeg is 9500 square miles. Total drainage area of rivers leading into Lake Winnipeg is 370,000 square miles, encompassing portions of three provinces and three states.

Northern coniferous forests dominate the eastern and northwestern portions of the lake area. Mixed-wood forests occur in southern and southwestern areas.

Marshes around the southern shores of Lake Winnipeg total over 150 square miles.

SUMMARY (page 5)

Lower Churchill River

The area studied was the main river channel from Missi Rapid to Hudson Bay. Climate in this area is quite severe with mean January temperatures approaching -20°F and frost free season only 60-80 days in length. Continuous permafrost is prevalent throughout parts of this area.

Bedrock changes within 90 miles of the mouth from Precambrian granites to Paleozoic Limestone. Overburden is very thick in some areas and muskeg is common.

Mean annual flow is 35,700 cfs. There are several rapids in the Lower Churchill River between its four lakes, and downstream above the estuary.

Vegetation is typically open coniferous forest although growth is heavier near the river. Marsh is not common throughout most reaches as bedrock control is prevalent on shorelines. Grasses and sedges grow on an ice-scoured shoreline zone.

Rat-Burntwood River

The area considered was the main diversion channel from South Bay on Southern Indian Lake to Split Lake. Climate of the area is cold, with long winters and short frost free seasons (80 days). Annual snowfall is 44-48 inches.

The bedrock throughout the area is Precambrian and relief is subdued by thick deposits of glacial and lacustrine origins.

Rat and Burntwood Rivers have average annual flows of only 1020 and 2980 cfs respectively. Total drainage of both of the rivers is 9870 square miles.

Forests are typical black spruce types prevalent in northern Shield areas. Large fires have influenced the vegetation. Major marshes are common along the upper Rat River and around Wuskwatim Lake. Extensive sections of willowed shorelines are prevalent in the former area.

METHODOLOGY

The method of operation consisted of a program of liaison, study and recommendation. Liaison was carried out with members of the Study Staff, other Study Board contractors, and Provincial and Federal personnel.

Lake Winnipeg

Field work consisted of aerial, canoe and ground waterfowl surveys, and inspection of colonial waterbird nesting sites.

Lower Churchill River

Aerial surveys were flown in spring, summer and fall to determine wildlife use of the river. A flight in mid-summer covered the portion of the river from Billard Lake to Hudson Bay. The main purpose of this flight was to determine use of the river by Canada geese.

Rat-Burntwood Diversion

Aerial surveys were conducted in spring, summer, fall and winter to determine wildlife present on the Rat and Burntwood Rivers. Surveys by boat for waterfowl were carried out in summer. Several plots were surveyed for evidence of moose browsing. Flights in winter along the Diversion Route were made to determine numbers and winter range of moose.

General

Manitoba Hydro engineering plans and water level and flow data were interpreted to gain an understanding of the physical effects of the project. Reports by other Study groups were analyzed and interpreted for wildlife resource purposes. Possible mitigation procedures were outlined and discussed. Those key issues and related most important mitigation requirements were isolated and presented as recommendations.

OBSERVATIONS AND CONCLUSIONS

Lake Winnipeg

Populations of muskrats in Netley-Libau marsh are currently at extremely low levels (.05 per acre). Recent low water levels and wind set-up during house-building are blamed for the low numbers. There have been five muskrats per acre yielding a total of 125,000 pelts in good years.

Muskrats are dependent upon good emergent growth for food and building material. They also require stable water levels during fall (house-building) and winter periods. High waters of 1970 destroyed many of the levees of Netley-Libau and killed much of the important emergent vegetation. Proposed high, stable water levels under regulation will result in short-term increase in muskrats, followed by a sharp decline as large areas of emergent vegetation stagnate and disappear.

SUMMARY (page 8)

Waterfowl production values on Lake Winnipeg are primarily within its large southern marshes. Even so, production is restricted in these areas by rapid inundation due to wind set-up. There were 20 breeding pairs of waterfowl per square mile (adjusted) in the major marshes during early June, 1973.

Many areas of Lake Winnipeg are important staging habitat for large numbers of ducks and geese. As many as 48,000 ducks have been observed in Netley-Libau marsh in fall. Canada and snow geese also use Lake Winnipeg in considerable numbers in fall.

Potential value of the marshes will decrease as nesting habitat diminishes under the stable, high water regime.

Several species of waterbirds have colonies on islands and reefs in the lake. Effect of the increased, stable levels on these species will be small, although there will be some loss of satellite colonies on low islands. Beach nesters such as Caspian and common terns will be especially affected.

Mitigation procedures are discussed under the following headings:

1. Establishment of a Co-ordination Committee for management of wildlife resources.
2. Consideration of marsh management techniques.
3. Management of specific areas for Canada geese.
4. Determination of optimal water regime.

Lower Churchill River

Populations of moose are generally low, due to harshness of climate and poor habitat. Most of the area from Missi Rapid to Billard Lake has a carrying capacity of 0.2 - 0.3 moose per square mile, while the area from Billard to Hudson Bay has a capacity below 0.2. Trappers and fishermen may shoot a few moose, but sport hunting is almost negligible due to low densities and difficulty of access.

Reduction of flows will not significantly affect the potential of the area to produce moose, although some of the islands used by moose during calving season may become accessible to predators with lowered lake levels.

Unless caribou change their present winter migration patterns, little effect will be felt by this species.

The autumn departure of polar bears from land to Hudson Bay may be significantly delayed by reduced production of ice. The problem period in Churchill communities could be extended if bears remain longer.

Reduction in lake surface areas will decrease productive capability of the river for trappers. Returns from most of the Registered Trap Lines along the river are small.

The river is important as summer brooding and fall staging habitat for Canada geese and other waterfowl. Most important to geese are the ice-scoured banks which offer grasses and sedges for grazing. It is probable that ice-scouring will decrease with diminution of flows following diversion.

Mitigation practices are discussed under the following headings:

1. Modification of proposed flows.
2. Regulation of lakes downstream of Missi Rapid.
3. Monitoring of wildlife resources.
4. Compensation for loss of trapping income.

SUMMARY (page 10)

Rat-Burntwood Diversion

Moose populations are low to moderate along the Diversion Route due to habitat and environmental constraints. Densities may approach .4 to .6 per square mile in the upper Rat and lower Burntwood Rivers areas where deciduous growth along shorelines is prevalent.

With flooding, potential numbers of moose displaced will be approximately 40-80 (Notigi), 20-40 (Wuskwatim) and 13-26 (Manasan). Shoreline hunting will be reduced and a conflict may develop between native and sport hunters.

There may be some indirect effects on barren-ground and woodland caribou through loss of range. With current low populations in the area, effects will be minor unless migration routes change.

Major species of furbearers trapped in the Rat-Burntwood area are beaver, lynx, mink and muskrat. The first two species account for 81 percent of all returns in the Nelson House Section. Total returns from Registered Traplines in the Nelson House Section which will be affected by the diversion averaged $43,050 per year for the period 1967-1972. Sixty-three percent of the active trappers in the Nelson House Section will lose trapping area through flooding.

A potential annual harvest loss of approximately 145 beaver could occur with development at Notigi, Wuskwatim and Manasan. With flooding, potential harvest of approximately 4,600 muskrats will be lost to trappers each year. Actual losses will be less because full harvests do not occur.

SUMMARY (page 11)

Value of the Diversion Route to breeding waterfowl is generally low. The upper Rat River and Wuskwatim Lake marshes do have good breeding habitat, however. Canada geese use the area east of Apussigamasi Lake in considerable numbers during fall. All of the currently available marsh habitat will be lost with flooding. Re-establishment of marshes may take several decades without clearing.

Mitigative procedures are discussed under the following headings:

1. Primary alternatives
2. Determination of optimal water regimes
3. Clearing
4. Diking
5. Compensation for loss of trapping income
6. Game harvest control
7. Avoiding harassment of wildlife

ACKNOWLEDGEMENTS

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Many agencies and individuals have contributed to this study. As acknowledgement of each individual is not possible, appreciation is collectively expressed for aid and co-operation.

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The following is a list of government agencies and groups that provided information and reports:

Province of Manitoba

Department of Mines, Resources and Environmental Management (D.M.R.E.M.)

- Mines and Surveys Branch, Forest Inventory
- Water Resources Branch, Planning Division
- Development and Extension Branch
- Research Branch
- Resource Management Division

ACKNOWLEDGEMENTS - Page 2

Canadian Wildlife Service

Study Board Office

The Study Board Office provided reports, maps and hydro-development plans as they became available, and helped obtain information from other study participants.

Study Participants

Other study participants provided information prior to completion of their final reports. Information from the Physical Impact Study was especially important. The socio-economic study group provided a preliminary report of their studies and participated in discussions.

PART 1

RECOMMENDATIONS

Certain wildlife issues require early consideration of mitigative action. They are discussed in the report and are identified in this part by section heading for each Study Area. Recommended procedures for lessening impact are numbered consecutively.

LAKE WINNIPEG

A. STAGNATION OF MARSHES WITH HIGHER RANGE OF RELATIVELY STABLE WATER LEVELS AFTER REGULATION

1. A committee should be created to co-ordinate management and establish priorities for wildlife habitat improvement on Lake Winnipeg. This committee, comprised of experts from Ducks Unlimited, the Canadian Wildlife Service and the Manitoba provincial government, should concern itself with management of the major marshes for optimum waterfowl and muskrat production. Success of colonial nesting birds should also be a priority.

2. Marsh management techniques should be considered for Netley-Libau marsh. Diking and pumping would allow manipulation of water levels to maximize productive habitat for muskrats and nesting and staging waterfowl. Creation of nesting islands, pothole blasting and ditching and planting of attractive food plants could increase the productivity of waterfowl in Netley-Libau.

3. Consideration should be given to management of specific areas for giant Canada geese. Stocking and creation of nesting platforms could speed establishment of new groups.

4. Water levels should be manipulated in managed marshes to minimize erosion and maximize habitat diversity. Levels should not be raised more than 6-12 inches during May and June or after freeze-up to avoid destruction of waterfowl nests and displacement of furbearers.

B. LOSS OF SOME OF THE SMALLER ISLANDS USED BY COLONIAL NESTING BIRDS

LOWER CHURCHILL RIVER

A. DELAYED FORMATION OF SHORELINE ICE MAY LENGTHEN TIME POLAR BEARS SPEND ON LAND AROUND CHURCHILL

B. LOSS OF STAGING AND REARING HABITAT FOR CANADA GEESE WITH PROBABLE DISAPPEARANCE OF ICE-SCOURING EFFECT

1. A system of monitoring effects of regulation on the wildlife along the river, and at the estuary should be established among all provincial, federal and private organizations concerned. On-going modifications in regimes could be suggested.

2. Consider maintaining sufficient flows in fall and winter to preserve ice-scouring effect on the river and encourage formation of local Hudson Bay land-fast ice.

C. POSSIBLE DESTRUCTION OF WATERFOWL NESTS IN MAY AND JUNE WHEN HEAVY FLOWS ARE RELEASED

3. Consideration should be given to releasing more even flows throughout May and June to minimize destruction of waterfowl nests.

D. MODIFICATIONS IN THE FLORA AND FAUNA OF THE ESTUARY WITH INCREASED FREQUENCY OF PENETRATION BY SEA WATER

4. Consideration should be given to construction of weirs to partially maintain levels of Northern Indian Lake and/or Fidler Lake, and to provide more even flows downstream.

E. LOSS OF INCOME FROM TRAPPING

5. Consider compensation for loss of trapping income.

RAT-BURNTWOOD DIVERSION

A. LOSS OF RIPARIAN SHORELINE HABITAT USED BY MOOSE, FURBEARERS, WATERFOWL AND OTHER SPECIES FOR FOOD AND COVER

B. POSSIBLE LOSS OF FURBEARERS AND DESTRUCTION OF HABITAT WITH POTENTIAL FLOODING TO 820 FEET ASL OR GREATER BEHIND ICE JAMS AT THIRD RAPIDS

C. LOSS OF MARSH HABITAT IN THE UPPER RAT RIVER AND WUSKWATIM LAKE

1. Consideration should be given to diking certain areas for maintenance of presently productive habitat. The large area west of Issett Lake would be a prime consideration for such mitigation measures.

D. LENGTH OF TIME FOR RE-ESTABLISHMENT OF SUITABLE WILDLIFE HABITAT

E. COLLECTION OF DEBRIS IN BAYS WITH LOW SHORELINES BY A BOOMING PROCESS

2. Water levels and flows should be regulated to speed shoreline re-establishment and minimize damage to wildlife and wildlife habitat.

3. Clearing should be done to replace prime wildlife habitat lost through flooding on an acre-for-acre basis.

4. Potentially productive bays, i.e., those with low shorelines which could re-establish to marsh, should not be used for booming.

F. LOSS OF SHORELINE HUNTING OPPORTUNITY BY NATIVES

G. CONFLICT BETWEEN SPORT AND NATIVE HUNTING

5. A management plan should be initiated to ensure that residents of Nelson House are allowed to harvest the number of moose required for their use without interference from recreational hunters. Such a plan might involve setting quotas, restricting seasons, or closing of certain areas to sport hunters. More information on the use and importance of wildlife as a food source for natives is necessary.

H. HARASSMENT OF WILDLIFE DURING CONSTRUCTION AND CLEARING PHASES

6. All employees involved in construction and related activities, especially pilots, should be instructed to avoid disturbing waterfowl, nesting colonies, eagles and ospreys, moose and caribou.

7. Nesting sites of eagles and ospreys should not be destroyed during clearing activities.

I. LOSS OF INCOME THROUGH TRAPPING

8. Consider compensation for loss of trapping income. This compensation could be based on the loss of areas actively trapped in those traplines affected by flooding. Alternative employment should also be considered.

9. Re-organization of trapline boundaries should be considered to allow trappers affected by flooding to trap on previously under-utilized traplines.

PART 2

OBJECTIVES

The purpose of this report is to identify important aspects of the wildlife resources of the following study areas: The Rat-Burntwood Diversion, the Lower Churchill River and Lake Winnipeg. Mitigation and enhancement possibilities that would benefit wildlife resources are considered.

Specific objectives were to:

1. Identify the nature and extent of probable effects of the development project on wildlife populations, habitats, wildlife resource uses, and wildlife management with emphasis upon critical areas and important considerations.

2. Evaluate the likely effects on wildlife species in relation to their importance to people and to the general ecology of the project area.

3. Determine and assess procedures and programs which would prevent, minimize or mitigate against adverse effects on wildlife populations and habitats and those which would enhance opportunities for wildlife resource use and development.

4. As they are identified and determined feasible, recommend mitigation procedures which would require modification in the engineering, design, construction or scheduling of the development project.

5. Develop guidelines for additional study and adjustment to wildlife resource management programs.

PART 3

TERMS OF REFERENCE

F.F. Slaney & Company were contracted to conduct wildlife resource studies for the Study Board. Studies began in late August, 1972 and were continued until March, 1974. The initial period was concerned primarily with the Outlet Lakes and a report on wildlife of that area was submitted to the Study Board in March, 1973. A report on wildlife of the Southern Indian Lake area was submitted to the Study Board in March, 1974.

F.F. Slaney & Company were to co-operate with other study participants, obtain and evaluate data, conduct necessary wildlife surveys and define important wildlife resources with regard to socio-economic implications. Recommendations were to be made to the Study Board on questions related to wildlife and wildlife habitat.

The Study Board was to co-ordinate the various study groups and provide data from other study groups as they became available. Information concerning vegetation, soils, forest resources, shorelines and physical and biological impact processes were to be provided to F.F. Slaney & Company by other Study Board contractors.

Field activities were to be co-ordinated through the Study Board field co-ordinator.

PART 4

THE STUDY AREAS

4.1 LAKE WINNIPEG

The Study Area is comprised of Lake Winnipeg and its immediate shoreline, including the major marshes. Geographical limits are approximately 50°15'N - 54°50'N and 96°15'W - 99°15'N (Key Map).

4.1.1 Climate

Lake Winnipeg lies entirely within the moist fringe of the "dry subhumid" region (Weir 1960). This large body of water and Lake Manitoba modify the climate in southern Manitoba. Annual precipitation varies from 20 inches in the southern portions of the Study Area to less than 18 inches in the north. Annual snowfall varies from 55-60 inches throughout the area and summer rainfall (May, June, July) increases from five inches in the northeast to eight inches in the southwest.

Average July and January temperatures vary from 64°-66°F and —8° to —2°F north to south. Frost-free season varies from 100-120 days also north to south. Mean number of degree days is 2500 in the south and less than 2000 in the north (Weir op. cit.).

4.1.2 Geology, Topography and Landforms

Geology of the Lake Winnipeg basin is quite complex as Silurian, Ordovician and Precambrian formations are present. Generally, Silurian dolomites (Interlake Group) are present on the west side, Precambrian granites and gneisses are present on the east side, and Ordovician limestone, dolomite, red shale and sandstone occur in the southeast. Undivided Ordovician material (generally limestones) is also present in the northwest portion (Weir 1960).

The topography of the Lake Winnipeg area has been greatly influenced by the post-glacial Lake Agassiz. The entire area was once covered by this large post-glacial lake. Shores of Lake Winnipeg have been divided into four physiographic divisions (Weir op. cit.). The entire east and west sides of the Lake are in the Transitional Zone of the Precambrian Shield and the Interlake-Westlake Plain of the Manitoba Lowlands, respectively. Approximately 20 miles of the extreme northern tip lie in the Upper Nelson Plain and approximately 60 miles of shoreline at the southern tip are in the Red River Plain. The eastern shore is typical of [illegible] lying shield areas. Relief is rolling to undulating, clays are dep[illegible] depressions and peat is abundant. Soils are mainly podzolic and organic. The western side has gentle relief with a shallow mantle of reworked calcareous till. The northern extreme has undulating topography. Lacustrine clay with areas of bedrock outcrops and bog are common.

4.1.3 Drainage Pattern

Surface area of Lake Winnipeg at mean level is approximately 9500 square miles. Total drainage area of rivers leading into the lake is 370,000 square miles. The drainage system encompasses portions of Alberta, Saskatchewan, Manitoba, Montana, North Dakota and Minnesota. The span of influence stretches from the Rocky Mountains to Lake Superior and south to the basin of the Mississippi River where the Red River drains north central United States farmlands. The North and South Saskatchewan Rivers drain most of Canada's prairie region.

The Winnipeg and Saskatchewan Rivers contribute 71% of the water to Lake Winnipeg while the Poplar, Pigeon, Berens, Bloodvein, Manitogotagan, Brokenhead, Dauphin, and Red Rivers contribute the remaining 29%.

The mean level of Lake Winnipeg historically has been 714.1 feet asl (1942 - 1971). Daily levels have ranged from a minimum of 708.61 feet asl to a maximum of 719.79 feet asl since records were started in 1913 (DMREM 1972).

4.1.4 Vegetation Types

Northern coniferous type forests dominate the eastern and northwestern areas. The most common species on the poorly drained land is black spruce (Picea mariana). Larch (Larix laricina) is also common. White spruce (Picea glauca),trembling aspen (Populus tremuloides), balsam poplar (Populus balsamifera), white birch (Betula papyrifera), and balsam fir (Abies balsamea) occur on alluvial soils with better drainage near rivers. Jack pine (Pinus banksiana) occurs on well drained ridges. Dominant shrubs include alder (Alnus sp.), dwarf birch (Betula sp.) and willows (Salix spp.).

On the southwest and southern portions of the area the predominate forest is mixed-wood type. Characteristic vegetation is white spruce, aspen and balsam poplar. An aspen-oak zone with burr oak (Quercus macrocarpa), balsam poplar and hazel (Corylus sp.) occurs in the extreme southwestern portion near Winnipeg Beach (Adams and Hutchison 1968; Hutchison and Adams 1971; Weir 1960).

4.1.5 Shorelines

The shorelines of the western side of Lake Winnipeg are generally low, composed of clay and till with boulders. Exposed limestone cliffs are found in the 'narrows.' Sand has accumulated in some areas and marshes have formed where aquatic plants became established in protected bays. Major marshes are usually associated with deltaic formations.

The southeastern shore, influenced by the Transition Zone of the Precambrian Shield, has largely sandy beaches with islands common near and offshore.

The extreme southern end of the lake, influenced by the Red River Delta, has extensive areas of marsh. In this region, most of the shores on the lake itself consist of organic material overlying clay. Varying amounts of sand have collected on the organic material (Impact study, 1974).

4.1.6 Marshes

Marshes of significant size (greater than 500 acres) are found mainly along the southern and eastern shores of Lake Winnipeg. Townsend (1971) lists nine major marshes on the lake. The marshes of the Red River Plain and Red River Delta are the most fertile in the area (Adams and Hutchison, 1968). The largest of these, Netley-Libau (55,000 acres, at elevation 713) has been an important waterfowl and furbearer habitat. Netley-Libau has contained up to 48,000 ducks during peak migration periods and has supported a maximum harvest of 125,000 muskrats (Stardom pers. comm.).

Bottom soils in the southern marshes are usually inorganic muds, muck, and peat overlying muck. Dominant emergent plants are hardstem bulrush (Scirpus acutus), cattail (Typha sp.), and common reed (Phragmites communis). Most abundant submergent plants include milfoil (Myriophyllum spp.), pondweeds (Potamogeton spp.), burreed (Sparganium angustifolium) and bladderwort (Utricularia vulgaris). Canada Land Inventory (ARDA) rating on this area is $2S_I$, indicative of an area with high productive and staging value to waterfowl. There is a limitation on productivity because of variation in levels due to wind set-up (Map 1). The Riverton-Hecla (9,300 acres), Fisher

Bay inner marsh and Willow Point (3,000 acres) marshes are the only other shoreline areas rated as having moderately high productive capabilities (Hutchison and Adams 1968).

Several marsh areas are rated as important migration stopovers, but have limited value as waterfowl production areas. These include Washow and Fisher Bays. In addition, there are several open-water areas along the lakeshore and close to islands rated as important to migrating waterfowl. Many of these occur in the northwest portion of the lake (Adams and Hutchison 1968; Hutchison and Adams 1971).

4.2 LOWER CHURCHILL RIVER

The Study Area dealt with in this report is the Lower Churchill River from Missi Rapid at the eastern edge of Southern Indian Lake ($98^{o}9'$W) to its mouth at Hudson Bay ($94^{o}11'$W). Approximately 280 miles of river are included in this area (Key Map).

4.2.1 Climate

The Lower Churchill River area lies within the Dfc region, a subarctic climate with short, warm summers and cold snowy winters (Koppen and Geiger 1936). Average temperatures in January and July are —17 to —19^{o}F and 54-58^{o}F respectively, lowest temperatures occurring at Churchill (Weir 1960).

Frost free season varies from 60-80 days from Churchill to Southern Indian Lake, and the number of degree days (above 42^{o}) varies from 700-1200, also in a northeast to southwest direction.

Because of the colder climate, more precipitation falls as snow in the Churchill region each year (50-55 inches) than near Southern Indian Lake (40-45) inches. Churchill, however, receives three inches less total precipitation (14 inches total) throughout the year than does the southwest portion of the study area. The entire area receives less than one inch precipitation in January.

The southern limit of continuous permafrost occurs along the lower Churchill River. Weir (1960) shows the limit as west of Billard Lake, while Ritchie (1962) indicates the limit is approximately at Red Head Rapids. Kendrew and Currie (1955) show that the southern limit follows the 23^{o}F mean annual isotherm. Newbury (1973) indicates that permafrost is prevalent throughout the entire Lower Churchill area.

Winter in the northeast half of the Study Area lasts 2-4 weeks longer (mean daily temperature greater than 32^{o}F) and summer is 2-4 weeks shorter (mean daily temperature greater than 42^{o}F).

4.2.2 Geology, Topography, and Landforms

From Southern Indian Lake to within 90 miles of Hudson Bay, the Churchill River flows over granites and granitic gneisses of the Precambrian Shield. For the last third of its length it flows over Paleozoic limestone, and enters Hudson Bay after flowing over a narrow band of Precambrian sandstones (Newbury 1973, Weir 1960).

Generally, the river is controlled by the underlying bedrock in both the horizontal and vertical planes, but control is mainly vertical in the easterly portions (Newbury op. cit.).

Overburden is generally thick, up to 150 feet in some areas. Overall relief is generally low, although there are several rapids in the more westerly portions of the river. Total drop in mean water surface elevation from Partridge Breast Lake to Billard Lake is 181 feet. From Missi Rapid to a point approximately 20 miles east of Billard Lake, the relief is generally bedrock controlled with extensive drift mantle. From this point to within 30 miles of Long Island, the River flows through hummocky disintegration moraine.

The edge of this moraine represents the former limits of the Tyrell Sea (Newbury 1973). Along approximately two-thirds of the estuary a continuous peat mantle with ice-wedge polygons predominates. Around the mouth are recent alluvial and marine deposits (Ritchie 1962).

Throughout the Canadian Shield portion of the Study Area, small lakes and a varying peat mantle with muskeg are prevalent. In the Lowlands, a heavy peat mantle predominates, lakes are more numerous and permafrost is more prevalent.

4.2.3 Drainage Patterns

The Churchill River system drains 85,000 square miles in Alberta, Saskatchewan and Manitoba. Drainage area in Manitoba covers 38,000 square miles. Tributaries flow south to meet the Churchill from within 50 miles of the Manitoba - N.W.T. boundary.

A broadening of the river in Manitoba, Southern Indian Lake, is 85 miles long and has a surface area of 1,060 square miles. Mean flow of the Churchill as it leaves Southern Indian Lake is 35,700 cfs and 40,000 cfs when it meets Hudson Bay at Churchill, Manitoba. The Churchill drops over several rapids from an elevation of 840 feet to sea level at the Bay.

The river widens into several lakes from Missi Rapid to Hudson Bay; these include Partridge Breast, Northern Indian, Fidler, and Billard Lakes. Total surface area of these lakes is approximately 100 square miles. Northern Indian Lake is the largest (67.2 square miles) and Billard Lake is the smallest (5 square miles).

LAKE	MEAN SURFACE ELEVATION (FEET)	SURFACE[a] AREA (SQ. MILES)
Partridge Breast	802.8	12.2
Northern Indian	772.8	67.2
Fidler Lake	758.6	15.6
Billard Lake	621.6	5.0

a - DMREM (1971)

The Little Churchill River and the Little Beaver River meet the Churchill River before it enters Hudson Bay. These two rivers have relatively small drainage areas, and add less than 20% of the total flow at the mouth.

4.2.4 Vegetation Types

The Study Area lies entirely within the Subarctic Belt described by Ritchie (1962). This area is characterized by a growing season which does not exceed 1,200 degree days and whose mean July temperature does not exceed 58^{0}F. The vegetation in this belt is primarily open coniferous forest or a mixture of forest and tundra. Ritchie (1962) states that the vegetation in the Shield portion of the Study Area is controlled by both climate and topography while vegetation in the Hudson Bay Lowlands is controlled mainly by topography, i.e. drainage pattern. In this latter region, climate, disturbance and history are important only as local, secondary factors.

4.2.4.1 Forests

Forests along the lower Churchill River are greatly influenced by the river. Trees are generally taller, and forests are denser for at least one mile from the river.

Ritchie (1962) has divided the vegetation of the Study Area into five different vegetation zones (Table 1). From Southern Indian Lake to Northern Indian Lake, from Northern Indian Lake to Fidler Lake and from Fidler Lake to Billard Lake, the Forests are classified as the Eastern Southern Indian Lake Section. Black spruce is the main tree species and it occurs as either closed spruce forest or in moss muskeg. Stands of shrubs are frequent. Willow and alder are the prevalent species. White birch occurs in small stands

TABLE 1

PHYSIOGRAPHIC REGIONS AND VEGETATION ZONES*

LOWER CHURCHILL RIVER, MANITOBA (SOUTHERN INDIAN LAKE - HUDSON BAY)

REACH	Physiographic Region	Vegetation Zones	Distance (Miles)	Description
(1) Missi Rapid-Partridge Breast Lake	PRECAMBRIAN SHIELD	EASTERN SOUTHERN INDIAN LAKE	100	Eastern Southern Indian Lake: black spruce predominate (closed forest and moss-muskeg). Jack pine is common on sand and gravel. Deciduous growth includes willow, alder, white birch, trembling aspen and balsam poplar.
(2) Partridge Breast Lake				
(3) Partridge Breast Lake-Northern Indian Lake				
(4) Northern Indian Lake		WESTERN SOUTHERN INDIAN LAKE	20	Western Southern Indian Lake: black spruce predominates. Mixed forests of white spruce, balsam fir, balsam poplar and trembling aspen occur on alluvial deposits. Jack pine dominates ridges and sand plains.
(5) Northern Indian Lake-Fidler Lake		UPPER CHURCHILL RIVER		
(6) Fidler Lake				
(7) Fidler Lake - Billard Lake			105	Upper Churchill River: Open black spruce muskeg on acid peat predominates. Low shrubs and mosses form secondary layer. Bogs are present in poorly drained sites and black spruce occupies heavy upland glacial material. Fire creates mixed forests of jack pine, white birch and trembling aspen. Continuous shrub communities along river courses are common.
(8) Billard Lake				
(9) Billard Lake - Little Churchill River				
(10) Little Churchill River - Portage Chute Rapids	HUDSON BAY LOWLANDS			
(11) Portage Chute Rapids - Red Head Rapids		CHURCHILL RIVER SILCOX	15	Silcox: continuous tracts of shrubby communities or moss muskeg. Occasionally, black spruce, larch fen, or jack pine are found.
(12) Red Head Rapids - Long Island				
(13) Long Island - Mosquito Point			60	Churchill River: inland, peat deposits are dominated by lichen and moss muskeg (black spruce prevalent) and larch fens. Near the estuaries, there are stands of white spruce on alluvium, associated with marsh, shrub and larch.
(14) Mosquito Point - Mouth				

*After Ritchie, 1962

as a secondary type. Jack pine grows in pure stands on sand and gravel. Deciduous trees are common around streams and burns, but seldom form large forests; white birch, trembling aspen and balsam poplar are the common species.

Most of Northern Indian Lake and Fidler Lake are in the Western Southern Indian Lake zone. Once again, black spruce is the major species. Generally, closed stands of this species are not common, although some occur on upland sites. On well drained ridges, white birch and less commonly, trembling aspen form small stands. In lowlands, on alluvial deposits, white spruce, balsam fir, balsam poplar, and trembling aspen form closed, mixed forests. Jack pine is the dominant tree on outcrop ridges and sand plains. Where soils are heavier, jack pine is replaced by black spruce (Table 1).

From Billard Lake to a point approximately half way between Portage Chute and Red Head Rapids, the forests are in the Upper Churchill River zone. The predominate vegetation type is moss muskeg with an open community of black spruce on acid peat. Poorly drained sites are occupied by bogs, while upland ridges of heavy glacial material have pure stands of black spruce. Common in areas of fire disturbance are jack pine, white birch, and trembling aspen. Stream and river banks generally have a continuous shrub vegetation.

A small portion of the river runs through the Silcox zone. Typically, vegetation is shrubby. Some moss muskeg occurs. Occasionally, closed black spruce, larch and jack pine forests are found. Taller, denser communities predominate near watercourses (Table 1).

The remainder of the Study Area lies in the Churchill vegetation zone. Peat deposits are generally inhabited by lichen and moss muskeg with black spruce in open stands. Near the estuary, white spruce occurs on alluvial deposits, with shrub and larch on younger sites.

4.2.5 Shorelines

The Churchill River from Missi Falls eastward is largely controlled by bedrock. Heavy glacial till deposits increase in depth to over 100 feet within 60 miles of Hudson Bay. From this point, lacustrine deposits of the Tyrrell Sea occur in decreasing thickness towards the mouth. Shorelines generally reflect the bedrock control and heavy glacial and lacustrine depositions. Potholes in the Hudson Bay Lowlands offer excellent cover for nesting Canada geese (Photo 1) and ice-scoured shorelines provide abundant green vegetation for feed. Usual vegetation below the ice-scoured line is grasses (Graminae) and sedges (Carex spp.) (Newbury 1973).

Almost 67% of the shoreline between Missi Rapid and Northern Indian Lake is bedrock-controlled. Of this, 57% is low-steep bedrock type. Ice-scoured till banks are common (16%) in certain areas of this reach, but low shorelines are found only in the bottom of small bays (Table 2).

Shorelines around Partridge Breast Lake are predominantly low bedrock (79%), although there are several small areas of low shoreline in bays. Northern Indian Lake has over 190 miles of shoreline, 87% of which is bedrock-controlled. There are frequent steep bedrock cliffs. Low shorelines occur, with a marshy fringe, but the marsh found on the lake is associated with low bedrock-controlled shorelines.

PHOTO 1

Muskeg potholes, Hudson Bay Lowlands. Canada geese nest in this type of habitat at approximately 5 pairs per square mile.

PHOTO 2

Small stream with marsh fringe leading into Fidler Lake, lower Churchill River. Waterfowl use these small marsh areas for breeding and staging.

PHOTO 3

Pair of Canada geese with brood along ice-scoured shoreline, lower Churchill River. Geese nesting along the river and in adjacent muskeg ponds bring their broods to the abundant grasses and sedges of these shorelines.

PHOTO 4

Grasses and sedges along ice-scoured shoreline east of Billard Lake, lower Churchill River. This area had been used heavily by feeding Canada geese.

PHOTO 5

Steep ice-scoured shoreline, lower Churchill River, August 1973. Some goose activity was noted along these shorelines, but less than on more level types.

PHOTO 6

Limestone cliffs at Portage Chute Rapids, lower Churchill River. Approximately 20% of shorelines from Portage Chute Rapids to Red Head Rapids are of this type. Value to most species of wildlife is low due to slope and lack of vegetation.

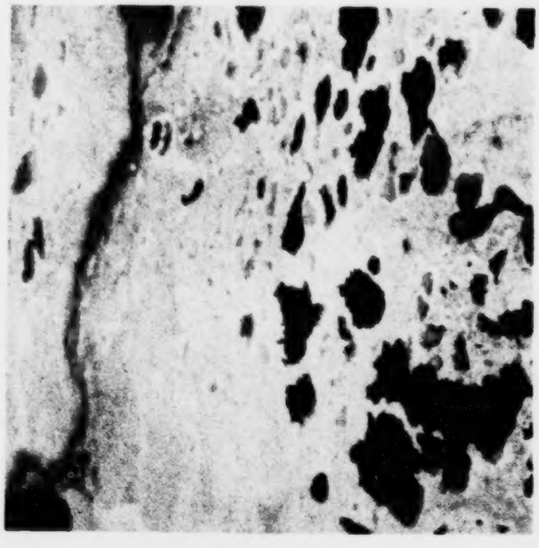
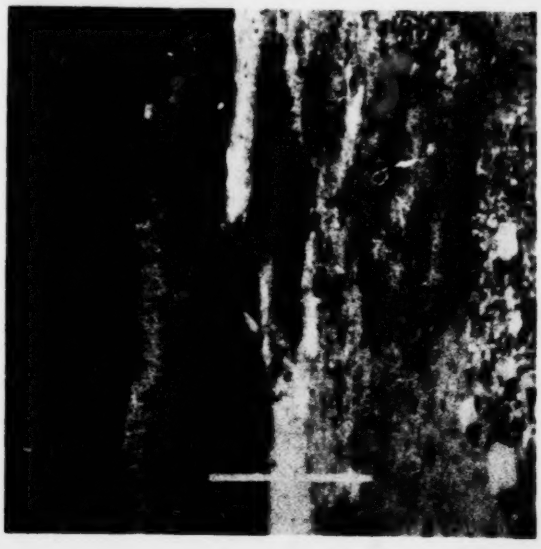



TABLE 2

SHORELINES, LOWER CHURCHILL RIVER, MANITOBA

	Steep* Bedrock		Low Bedrock		Low Bedrock Controlled		Ice-Scoured Till		Medium-Steep Sediment		Slumping Over-burden		Low		Total	% Marsh or Marsh Fringe
	mi.	%	mi.	%	mi.	%	mi.	%	mi.	%	mi.	%	mi.	%	mi.	
Missi Rapid-Northern Indian L.	16.6	8.4	96.5	49.0	19.3	9.8	31.0	15.7	16.9	8.6			16.6	8.4	196.9	.5
Partridge Breast L.			7.7	78.7	.3	3.0							1.8	18.4	9.8	
Northern Indian L.	17.8	9.3	90.0	46.8	59.7	31.0	3.0	1.6	10.8	5.6			10.9	5.7	192.2	5.8
Northern Indian-Fidler Lake			3.6	9.7	6.5	17.5	.6	1.6	11.3	30.4			15.2	40.8	37.2	10.6
Fidler Lake			1.8	9.0	6.5	32.5							11.7	58.5	20.0	11.3
Fidler L.-Billard L.			27.6	36.2	30.4	39.9			11.8	15.5	2.4	3.1	4.0	5.2	76.2	
Billard Lake			0.8	11.8	.2	2.9			4.0	58.8			1.8	6.8	6.8	17.6
Billard L.-Little Churchill River			18.0	15.5	12.4	10.7	44.0	37.8	13.2	11.4	11.0	10.0	17.6	11.3	116.2	3.8
Little Churchill R.-Portage Chute Rapids	1.6	2.2	.4	.5			69.4	93.8			2.6	3.5			74.0	
Portage Chute Rapids-Red Head Rapids	16.0	20.5					54.5	69.9			7.5	9.6			78.0	
Red Head Rapids - Long Island							34.8	76.1			10.9	23.9			45.7	
Long Island - Mosquito Point			8.0	18.7									34.8	81.3	42.8	11.2
TOTALS	52.0	5.9	254.4	28.4	135.3	15.1	237.3	26.5	68.0	7.6	34.4	3.8	114.4	12.7	895.8	3.2

* Shoreline types Missi Rapid-Fidler Lake (Impact Study 1974); shorelines Fidler L.-Hudson Bay (Newbury 1973).

From Northern Indian Lake to Fidler Lake, bedrock control becomes less (27%) and low shores are common (33%). Medium-steep sediment shorelines comprise the remaining 30%. The majority of shorelines on Fidler Lake are low; marshes are frequent in bays (Photo 2).

Between Fidler and Billard Lakes, most shorelines are bedrock-controlled (76%), but ice-scoured shorelines are common (Photos 3 & 4). The seven miles of shoreline around Billard Lake are mainly medium-steep sediment types. A small portion of the shores on this lake are low bedrock-controlled while the remainder are low, marsh type.

For several miles east of Billard Lake, there are low shorelines with good marsh growth. Ice-scoured till banks become prevalent from this point to Long Island; 65% of the shoreline is of this type (Photo 5).

Near Portage Chute Rapids, steep limestone cliffs are common (Photo 6). Off these cliffs and the ice-scoured till banks that predominate to Long Island, marsh development is rare.

The estuary has primarily low shorelines (81%) and marsh is common. Potholes are common in the backshore (Newbury 1973).

4.3 RAT-BURNTWOOD DIVERSION

The area dealt with in this report covers the diversion route from South Bay, Southern Indian Lake (56°N, 99°W) to the western edge of Split Lake (Key Map).

4.3.1 Climate

The entire Study Area lies within the Dfc region, a subarctic climate with short, warm summers and cold, snowy winters, described by Koppen and Geiger (1936). Average temperatures in January and July are -13° to -16° F and 59° to 61° F, respectively. Average frost-free season is approximately 80 days and mean number of degree days varies from 1200 - 1600 (North to South). Average annual precipitation is approximately 17 inches with 6 - 8 inches falling as rain in May, June and July. Annual snowfall is 44 - 48 inches, increasing from west to east (Weir 1960).

4.3.2 Geology, Topography and Landforms

Both the Rat and Burntwood Rivers (to Split Lake) flow over Precambrian Shield. Drainage pattern of the two rivers is mainly controlled by this formation, with some control coming from Lake Agassiz deposits (Newbury 1973).

The Diversion Route lies entirely in the Churchill province of the Shield. Bedrock is predominately granitic; wide belts of gneissic and volcanic rock are common. Relief along the entire system is rather low. Topography is mainly controlled by bedrock. Muskegs are common and lakes are frequent. Thick clay mantles usually subdue the relief (Beke, Veldhuis and Thie 1973).

Landforms are glacial and lacustrine in origin. Glacial deposits have been subdued by this submersion in Glacial Lake Agassiz. The most common type of landform is lacustrine. These sediments are highly calcareous and have a clay texture, and may be up to 75 feet thick (Beke, Veldhuis and Thie op. cit.).

Soils of the Study Area are in two zones of the Luvisolic soil region (classification depending on presence or absence of permafrost). Mineral soils present belong to the Luvisolic, Brunisolic and Gleysolic Orders; organic soils are also common (Beke, Veldhuis and Thie op. cit.).

Beke, Veldhuis and Thie (op. cit.) have divided the Study Area into 12 Land Districts in the Boreal Land Region, based on bedrock control and type and extent of surficial deposits. The Issett Lake District is generally low with thick organic deposits on lacustrine materials. Relief increases sharply through the Rat Lake and Notigi Lake Land Districts. Deposits are deeper and there is less exposed bedrock around Rat Lake. Permafrost can occur in both Districts, but is found extensively in peat around Notigi Lake. Relief is more gentle from Notigi to Threepoint Lake, although bedrock outcrops are common. Relief is generally low to Wuskwatim Lake. Peat accumulations are common over the deep lacustrine deposits. Wuskwatim Lake has typically low relief plains of peat and lacustrine deposits (clay and silt). Permafrost is found extensively in peat deposits and in some mineral soils.

From Wuskwatim Lake to a few miles west of Thompson topography is low, shaped by thick lacustrine deposits. Relief gradually increases easterly along the river as exposed bedrock becomes more frequent and glacio-fluvial deposits become prevalent (Beke, Veldhuis and Thie op. cit.).

4.3.3 Drainage Pattern

The Rat River system drains 2530 square miles and its mean annual flow is 1,020 cfs. The Burntwood River drains 7340 square miles and has an annual flow of 2,980 cfs. Both the Rat and the Burntwood begin in lakes very close to the Churchill River system, separated only by low heights of land. The Rat River begins in Issett Lake, approximately eight miles from South Bay, while the Burntwood River begins in Burntwood Lake, near Flatrock Lake on the Churchill River.

There are 6 lakes along the Rat River with a total surface area of 53.2 square miles. The Rat River ends at the northwest corner of Threepoint Lake where it meets the Burntwood flowing in from the south. To Split Lake, the Burntwood River flows through 4 lakes, with a total surface area of 33.8 square miles. Total length of the rivers in the Study Area is 110 miles (Rat) and 145 miles (Burntwood).

4.3.4 Vegetation Types

The entire Study Area lies within the Northern Coniferous Zone described by Ritchie (1962). Typical black spruce forests prevail on the glacial and alluvial soils. Deciduous growth is limited to areas of regeneration and near watercourses.

4.3.4.1 Forests

Forests along the Rat and Burntwood Rivers have been influenced a great deal by fires. Deciduous stands, therefore, with balsam poplar and white birch are common. In unburned and older stands, black spruce dominates on wetter sites; white spruce is common on better drained uplands. Understory is usually willow and alder. Currants (*Ribes* spp.) and mosses are common in the understory (Newbury 1973).

TABLE 3
SHORELINES, NOTIGI RESERVOIR
(from Impact Study, 1974)

REACH	STEEP BEDROCK		LOW BEDROCK		LOW BEDROCK-CONTROLLED		MEDIUM-STEEP SEDIMENT		LOW*		TOTAL	% MARSH OR MARSH FRINGE
	mi.	%	mi.	%	mi.	%	mi.	%	mi.	%	mi.	%
Issett Lake							2.7	39.1	4.2	60.9	6.9	60.9
Issett L. - Karsakuwigamak Lake			11.5	27.7			2.8	6.7	27.2	65.5	41.5	65.5
Karsakuwigamak Lake	1.2	5.8	9.9	47.6	1.3	6.2	3.5	16.8	4.9	23.6	20.8	23.6
Karsakuwigamak Lake - Pemichigamau Lake			3.2	61.5			2.0	38.5			5.2	0
Pemichigamau Lake			16.4	54.3	9.6	31.8	3.0	9.9	1.2	4.0	30.2	4.0
Pemichigamau Lake - Rat Lake			4.1	33.9	2.5	20.7	3.6	29.8	1.9	15.7	12.1	15.7
Rat Lake	.2	.1	116.4	83.4	8.0	5.7	2.9	2.1	12.0	8.6	139.0	8.6
Reading River			26.9	49.8	1.0	1.9			26.3	48.7	54.2	13.5
Mynarski Lake			12.3	40.8	7.4	24.3			10.6f	34.9	30.4	8.6
Suwannee River							11.9	61.7	5.8f 1.6	38.4	19.3	38.3
Rat Lake - Misinagu Lake			29.5	61.0	12.6	26.0	0.9	1.9	5.4	11.1	48.4	11.1
Misinagu Lake			8.7	86.1	1.0	9.9			0.4	4.0	10.1	4.0
Misinagu Lake - Notigi Lake			7.4	44.6	2.2	13.3	7.0	42.2			16.6	0
Notigi Lake	2.2	5.9	15.9	43.0	6.6	17.8	0.6	1.6	11.7	31.6	37.0	31.6
Notigi Lake - Control Structure			6.8	37.4	6.8	37.4	4.3	23.6	0.3	1.6	18.2	1.6
TOTALS	3.6	0.7	269.1	54.9	59.0	12.0	45.2	9.2	113.5	23.1	490.4	17.8

* - Includes types 24, 26, 28. Fen (type 31) designated by f.

NOTE: Shoreline descriptions from Impact Study, 1974.

Typical sequence of forests on moist sites is birch-willow shrub --- open pine forest --- open pine forest with spruce --- mixed black spruce --- white birch forest --- closed black spruce (Beke, Veldhuis, and Thie 1973).

Between Misinagu and Notigi Lakes, areas of thin soil, the result of erosion after fires, support only scrub growth of trembling aspen, alder and white birch. Jack pine and black spruce are interspersed among the deciduous growth. Grasses (Graminae) and lichens are common understory plants (Newbury op. cit.).

Between Notigi and Wuskwatim Lakes, bedrock control is evident. Drainage is generally good, and the vegetation is dense, unless influenced by fire or poorly drained alluvium. Forests around Opegano and Birch Tree Lakes are generally open coniferous types.

Most of the forest in the Apussigamasi to Split Lake area is largely regeneration type as a great deal of the area has been burned. Closed coniferous forest, with black spruce predominating, is found where fire has not reached.

4.3.5 Shorelines

Shoreline types along the Diversion Route from South Bay to the control structure below Notigi Lake have been determined by the Shoreline Impact Group (1974). From the control structure to Split Lake, information on shorelines was taken from Newbury (1973).

The general low relief from Issett Lake to Karsakuwigamak Lake is reflected in the predominance of low shorelines (Table 3). The Rat River in this area is generally winding, and has extensive marsh and willow shrub developed along its shoreline (Photo 7). Offshore

TABLE 4

SHORELINES, NOTIGI STRUCTURE - SPLIT LAKE

(from Newbury, 1973)

REACH	LOW BEDROCK		LOW BEDROCK CONTROLLED		MEDIUM-STEEP SEDIMENT		SLUMPING OVERBURDEN		LOW*		TOTAL	% MARSH OR MARSH FRINGE
	mi.	%	mi.	%	mi.	%	mi.	%	mi.	%	mi.	
Notigi Structure-Wapisu Lake			2.2	38.6	3.5	61.4					5.7	
Wapisu Lake	50.1	61.0	26.0	31.7	1.5	1.8			4.5	5.5	82.1	5.5
Wapisu L.- Threepoint Lake	1.7	13.2	6.7	51.9	4.5	34.9					12.9	
Threepoint Lake	27.5	43.9	3.3	5.3	31.3	50.0			.5	0.8	62.6	.8
Threepoint Lake - Wuskwatim Lake	5.5	20.1	10.4	38.1	9.9	36.3			1.5	5.5	27.3	5.5
Wuskwatim Lake	22.8	42.1	6.7	12.4	14.6	27.0			10.0	18.5	54.1	18.5
Wuskwatim Lake - Opegano Lake	$\frac{.7^{s}}{5.0}$	$\frac{3.6}{25.5}$	8.2	41.8	5.7	29.1					19.6	
Opegano Lake	2.7	47.4			1.0	17.5	1.5	26.3	0.5	8.8	5.7	8.8
Opegano Lake - Birch Tree Lake	7.0	21.0	13.9	41.8	2.5	7.5	9.9	29.7			33.3	
Birch Tree Lake			1.5	23.1	.8	12.3	0.7	10.8	3.5	53.8	6.5	53.8
Birch Tree Lake - Apussigamasi Lake	8.4	33.9	1.0	4.0	15.4	62.1					24.8	
Apussigamasi Lake	22.3	76.1					5.0	17.1	2.0	6.8	29.3	6.8
Apussigamasi Lake - Odei River	24.3	22.9	37.7	35.5	18.8	17.7	24.8	23.4	0.5	0.5	106.1	0.5
Odei River - Split Lake	1.5	6.9	17.9	81.7			2.5	11.4			21.9	
TOTAL	179.5	38.0	135.5	28.7	109.5	23.2	44.4	9.4	23.0	4.9	491.9	4.9

* Types 24, 26, 27, 28 (Newbury)

s - steep bedrock

vegetation is usually horsetail (Equisetum sp.), pondweeds and bulrush. Sedge meadows are common. Value to moose, nesting waterfowl and furbearers is at least as high as in any other area along the Diversion Route (Photos 8 and 9).

A few miles above Karsakuwigamak Lake, the gradient of the river increases and bedrock-controlled shorelines begin to predominate. This control is exerted on the river throughout most of its length, until it empties into Threepoint Lake. From 43 - 86% of the lake shorelines from Karsakuwigamak Lake to Threepoint Lake are low bedrock-controlled (Table 3 and 4). Less than 18% (80 miles) of the shoreline is low sediment type; occurrence is largely in shallow embayments. Low bedrock-controlled shorelines with beach development are common on Pemichigamau, Notigi and Wapisu Lakes. A thin fringe of sedge and willow occurs on shore.

Threepoint Lake has mainly low bedrock shorelines, although 38% of the shoreline is low sediment type. Beaches are common on Threepoint Lake. Wuskwatim Lake is also largely bedrock-controlled although low alluvial and marsh types comprise 48%. Marshes around Wuskwatim Lake attract large flocks of staging waterfowl (Photo 10).

Opegano and Birch Tree Lakes are situated in very deep deposits of lacustrine material. Slumping shorelines are common. Although small in total miles, marsh development is more extensive in Birch Tree Lake (54%) than it is in Opegano Lake. The Burntwood River in this area is mostly bedrock-controlled.

Apussigamasi Lake is largely bedrock-controlled, although there is heavy overburden in embayments. There are a few miles of sedge-willow development associated with the low shorelines on Apussigamasi Lake

(Photos 11 and 12). The river channel to Split Lake rests on bedrock. Thick lacustrine deposits are present and infrequent marsh usually occurs only in bays.

PHOTO 7

Meandering stream, low willowed shoreline, upper Rat River. Use of this habitat by furbearers, ungulates and waterfowl is the highest along the Diversion Route. There are approximately 50 miles of these low shorelines from Issett Lake to Karsakuwigamak Lake.

PHOTO 8

Beaver burrow in low shoreline, Rat River.

PHOTO 9

Low shoreline with emergent plant and willow fringe, Rat River. Furbearers, waterfowl and a wide variety of small birds and mammals use these shorelines.

PHOTO 10

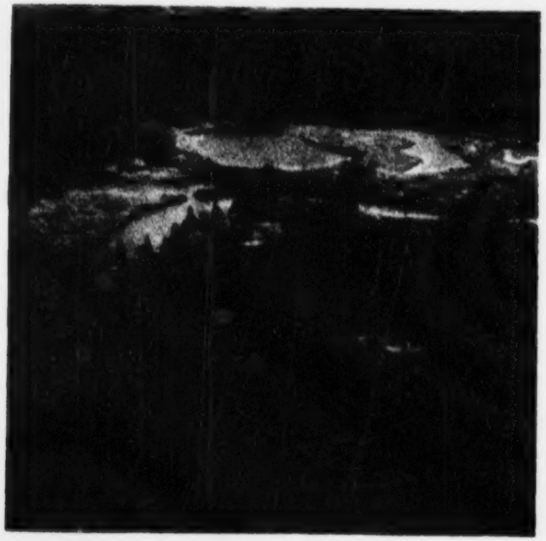
Sedge meadow and marsh fringe, Wuskwatim Lake. Use of this area was highest by staging waterfowl in September.

PHOTO 11

Sedge-willow community, Apussigamasi Lake. This type of habitat offers browse to moose.

PHOTO 12

Deciduous growth on burn, typical bedrock-controlled shoreline, Apussigamasi Lake. Browsing by moose in this area had been slight.



PART 5

METHODOLOGY

5.1 THE WILDLIFE PROGRAM

The wildlife program consisted of liaison, study and recommendation. The liaison function involved meetings and discussions in Manitoba with the Study Board Staff and members of the other Study Groups. Discussions with research, planning and operational personnel of Manitoba's Department of Mines, Resources and Environmental Management (DMREM) and with Canadian Wildlife Service Biologists provided a basis for obtaining data and reports pertaining to the Study Areas. Results of the wildlife study and recommendations derived from all data sources are included in this report.

5.2 INFORMATION GATHERED

Information pertinent to the Study Areas was obtained by various means. Most important was a program of field work from June 1973 through March 1974 that consisted of interviews, aerial reconnaissance, survey flights and boat and ground work (Appendices 1-6).

Time and budget limitations necessitated concentrating field activities in areas judged to be of prime significance to important species of wildlife. Preliminary judgments were made during aerial reconnaissance of the Study Areas.

In all areas, only those wildlife species of socio-economic importance and which could be most affected by the project were studied.

5.2.1 Lake Winnipeg

Field work on Lake Winnipeg consisted of an aerial waterfowl survey of marshes, inspection of the Folster Lake area in the Netley-Libau marsh, and a shoreline and boat survey of Folster Lake (Appendices 1 and 2). All sightings of birds were recorded. Seabird nesting colonies were inspected. Observations were made of species present, numbers of nests and young, location of nests, nest material and the general physical nature of the islands.

5.2.2 Lower Churchill River

Aerial waterfowl surveys were flown along the lower Churchill River and selected shorelines of lakes along the river (Appendices 1 and 3). Survey methods were similar to those used along the Diversion. Sightings of all birds were recorded and related to shoreline types. An attempt was made to locate as many broods and nesting sites as possible.

A reconnaissance survey was flown from Billard Lake downstream to Churchill. The survey provided information on shorelines and habitat, and wildlife use of the Churchill River estuary.

5.2.3 Rat-Burntwood Diversion

Waterfowl surveys were flown along shorelines of the Diversion Route within 500 feet of the shore at an altitude of 100 feet and air speed of 90-100 miles per hour. Altitude varied with wind conditions, but did not exceed 300 feet during actual survey time. All surveys were flown in suitable weather conditions (Appendix 4).

Boat surveys were undertaken along shorelines of the Diversion. Surveys followed close to shore so that waterfowl would be flushed from cover. Moose habitat utilization was noted on aerial and boat surveys. Moose browse plots were evaluated during boat surveys and by landings with a float plane. At each location browse plots of 100 square feet were inspected along the shoreline and in the backshore area, i.e., the area immediately behind the shoreline vegetation. A subjective estimate was made of plant species present and the degree of utilization by moose.

A winter moose survey was flown in February 1974 (Appendix 5). Transects were flown in blocks in areas deemed to have the most potential as winter range, mostly within the proposed floodline. The habitat in which moose were sighted was carefully noted.

Interviews with trappers from Nelson House were held in March 1974 to determine from native people specific wildlife habitat distribution on traplines in the Study Area. Emphasis was placed on the furbearer resource although discussions on moose and waterfowl were included.

5.3 REPORT DEVELOPMENT

Information and maps concerning the physical impact in the future Notigi reservoir and the Churchill River from Missi Rapid to Fidler Lake were provided by the Physical Impact Study (1974). Shoreline information along the remaining portions of the Diversion and Lower Churchill River provided by the Physical Impact Study (Newbury 1973) was used extensively. Wildlife information was related to shoreline types wherever possible.

Information on vegetation types within the floodline along the Diversion was derived from the Forest Resources report (Flanders, Lamont and Kaye 1973) and forest inventory data supplied by the Forest Inventory Branch of DMREM. This information was helpful in determining habitat types and capability to support the major wildlife species.

Canadian Wildlife Service personnel provided unpublished waterfowl staging survey data. Personnel from DMREM in Winnipeg supplied reports, big game and waterfowl harvest statistics, fur harvest data and maps of Registered Trapline Sections. Interviews with government biologists and conservation officers provided information on the wildlife resources and their utilization in the Study Areas.

Fur harvest statistics were obtained from the DMREM regional office at The Pas. The data were analyzed to provide an understanding of the value of the resource to the region, specifically to the economy of Nelson House. As the accuracy of the original harvest data is questionnable, the accuracy of the tables prepared from the data, is therefore also limited. The source of the data used was considered to be the most reliable for the purposes of this report.

The Study Board Staff provided maps, photo mosaics, engineering plans and schedules, floodline information, reports by other Study participants and assisted in obtaining water level and flow information from Manitoba Hydro. Study participants provided unpublished data and maps and general project information through informal discussions.

Previous authors (Welch et al. 1966, Goulden et al. 1968, and Underwood McLellan 1970) discussed the impact of development on wildlife resources in the Diversion areas. Their reports were reviewed.

A number of reports on marsh management programs on Lake Winnipeg were also reviewed.

Manitoba Hydro engineering plans and water level and flow data were interpreted in an attempt to understand the physical effects of the project (Appendix 15). Insofar as it was possible, physical effects were determined and evaluated.

Potential wildlife effects of significant nature were identified by survey. For each of the main wildlife involvements, possible mitigation procedures were considered. Those key issues and related mitigation requirements are presented as recommendations.

PART 6

OBSERVATIONS AND CONCLUSIONS

6.1 LAKE WINNIPEG

6.1.1 Current Status of Important Wildlife Resources

This part includes sections on the current status of furbearers, waterfowl and colonial nesting bird species which may be affected by changes in water levels and water regimes on Lake Winnipeg.

6.1.2 Furbearers

Furbearer habitat exists along the shorelines of much of Lake Winnipeg and its marsh areas. Most of the lake is included in Registered Trapline (RTL) Sections, except for the southwestern portion. Those areas not in RTL's are open to any trapper. Beaver (*Castor canadensis*), mink (*Mustela vision*), lynx (*Lynx canadensis*), otter (*Lutra canadensis*), fisher (*Martes pennanti*) and muskrat (Ondatra zibethicus) are furbearers found along shorelines, along streams flowing into the lake, and associated with marshes.

Marshes in the southern portion of Lake Winnipeg provide large areas of muskrat habitat. The Netley-Libau marsh area has been classed as having high muskrat density (DMREM 1961). In 1954 the population was estimated at 277,000 animals; there was a harvest of 125,000 pelts. This was a period of high water after dry years and vegetation was in an excellent state for muskrat production. Similarly, a high was reached in 1944, in response to water levels that had risen from lows in the 1930's (McLeod *et al*. 1951). Muskrat populations in the Netley-Libau marsh are now low; perhaps as low as 3,000 animals (Dick Stardom pers. comm.). Low water levels during spring and summer and extreme wind set-up effects during fall of 1973 are the probable cause. High water levels of 1970 damaged levees, allowing water to fluctuate greatly even at the far reaches of the marsh.

Muskrat densities can be very high in productive marsh habitat. In Alberta, Schmitke (1971) estimated a density of 5.4 to 9.7 per acre in his study area.

In the Peace-Athabasca Delta densities ranged from 0.1 to 11.4 muskrats per acre of emergent vegetation (Ambrock and Allison 1973). Muskrat houses in this area contained an average of 5 muskrats in winter, while bank burrows had an average of three muskrats. There were 17.6 bank runs per mile of emergent shoreline (55 muskrats per mile). Current density in Netley-Libau is in the order of .05 animals per acre (Stardom pers. comm.).

6.1.2.1 Habitat Relationships

Muskrat populations depend on good habitat (reed-swamp) to provide a suitable supply of rooted aquatic vegetation. Species and abundance of food plants is dependent on water levels as well as edaphic factors.

For marshes at the south ends of Lakes Manitoba and Winnipeg, McLeod et al. (1959) observed the following general distribution of marsh vegetation according to water depth:

Water Depth	Plant Species
0 feet	Sedge
0-1 foot	Common reed
1-3 feet	Cattail, Bulrush and Horsetail
3-5 feet	Bulrush
5+ feet	Pondweed

They found that plant species eaten by muskrats varied according to season of the year and abundance in particular marshes. Diversity in numbers of species in an important factor.

In the Peace-Athabasca Delta, common reed was the most important followed by a mixed emergent stand, horsetail, and bulrush (Ambrock and Allison 1973). These plants could survive in water as deep as 2.5 feet.

Ambrock and Allison (1973) present a comparison of productivity of the major muskrat habitat types in the Peace-Athabasca Delta.

Vegetation Type	Houses/Acre	Muskrats/Acre	Index of Use
Horsetail	1.5	7.5	1.0
Bulrush	0.3	1.5	1.8
Common reed	2.5	12.5	2.3
Mixed emergents	0.7	3.5	2.3

Similar relationships probably exist in Netley-Libau. Winter food supply is widely believed to be of critical importance to muskrats (Schmitke 1971; Errington 1963; Stevens 1953). After freeze-up, muskrats are restricted to submergent plants and the parts of emergent plants not locked in ice. McLeod *et al*. (1951) found that horsetail, pondweeds and bulrush were particularly important winter food because of their availability under ice.

The structures built by muskrats can be classified into five types: houses, bank burrows, nests, feeding platforms and pushups.

After freeze-up (late October), muskrats use vegetation to construct dome-shaped structures ("pushups") above holes in the ice. The insulating effects of the air contained in the pushup combined with the activities of the muskrats maintain an ice-free hole. Pushups are used mainly as feeding platforms but sometimes muskrats use them as temporary living quarters if they are frozen out of their houses or bank burrows.

When flood conditions occur, many muskrat houses may be destroyed and bank burrows flooded, leaving the animals exposed. Olsen (1959) found that a rise of more than two feet in the Delta Marsh, Manitoba, virtually eliminated the young born at the time. Similar conclusions were reached by Bellrose and Brown (1941) for muskrats in Illinois. The optimum depth during summer is between 12 and 18 inches (Bellrose and Brown 1941).

Muskrat productivity can be very high. McLeod et al. (1951) reported that some muskrats gave birth to four litters per year in two of the three years of their study, although the percentage producing fourth litters was small (1.6 and 0.9 percent). As the summer season is shorter, muskrats in the area probably give birth to no more than two litters. The annual mortality rate can be as high as 90% whether the population is trapped or not (Schmitke 1971). In the Peace-Athabasca Delta winter survival was 45% in 1971-72 (Ambrock and Allison 1973).

In the marshes at the southern ends of Lakes Winnipeg and Manitoba, McLeod et al. (1951) found the first litters of muskrats appearing in mid to late May.

6.1.3 Waterfowl

Few of Lake Winnipeg's 900 shoreline miles offer good habitat to waterfowl (Townsend 1969). The major importance of the lake to waterfowl lies in its nine major marshes. Total area of these marshes is approximately 142 square miles. Netley-Libau marsh (Photo 13) is the largest (86 square miles). Value to nesting waterfowl throughout most of these marsh areas is limited, however, by fluctuating water levels (Adams and Hutchison 1968).

PHOTO 13

Netley-Libau marsh, spring 1973.

PHOTO 14

St. Martin Islands, Lake Winnipeg. Small satellite islands are used by colonial nesting birds during years of reduced water levels.

PHOTO 15

White pelican and double-crested cormorant colony, St. Martin Islands, Lake Winnipeg.

PHOTO 16

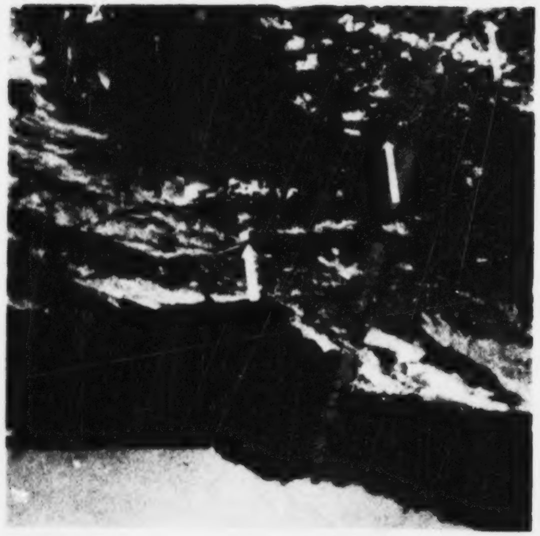
White pelican and double-crested cormorant colony, Pipestone Rock, Lake Winnipeg.

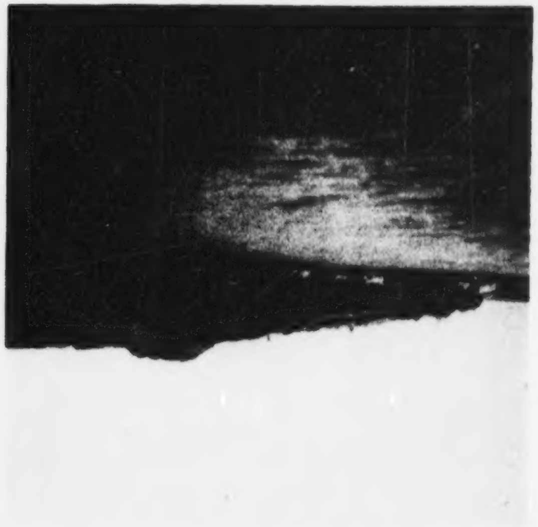
PHOTO 17

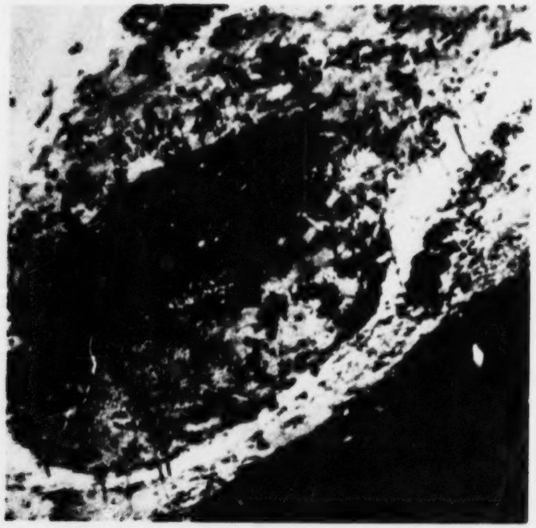
White pelican nest sites, Pipestone Rock.

PHOTO 18

Typical double-crested cormorant nests, Pipestone Rock.







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6.1.3.1 Production

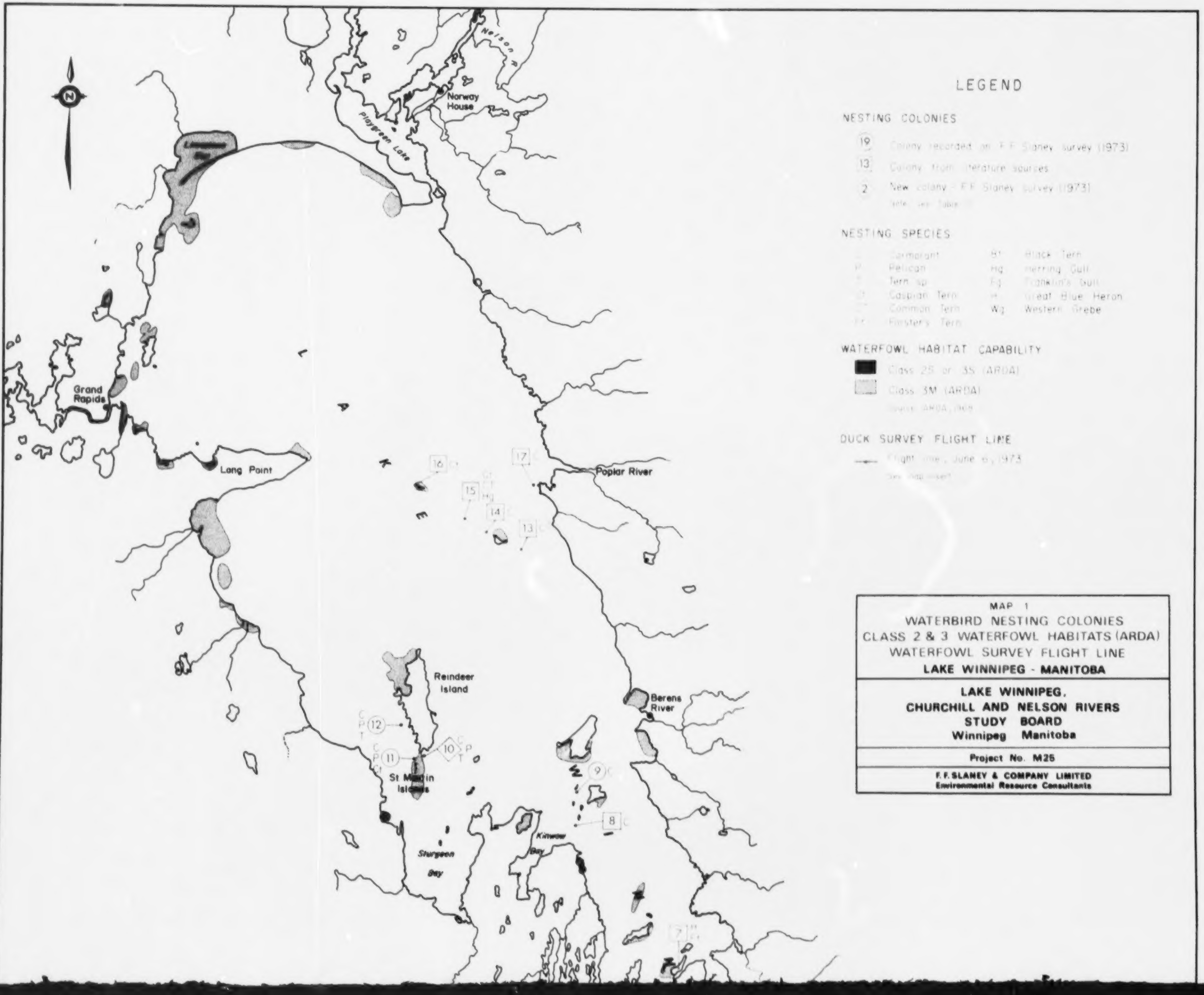
Flights in early June 1973 (Map 1) showed that Beaconia marsh had the highest number of waterfowl (18.4 per flight mile) while Folster Lake, Hecla Island and Grand Beach marshes had 14.9, 13.3 and 12.5 ducks and geese per flight mile respectively. Willow Point, Victoria Beach and Riverton marshes had only 3.9 - 6.6 waterfowl per mile. Netley-Libau marsh was among the lowest, with 5.1 ducks per mile.

Canada geese (Branta canadensis) were observed in Folster Lake, Hecla Island and Riverton marshes. Highest occurrence of these birds was in Riverton marsh (Table 5).

Numbers of ducks were generally low in most areas. Most abundant species were mallard (Anas platyrhynchos) and blue-winged teal (Anas discors). Heaviest concentrations of mallards were observed in Beaconia marsh. Blue-winged teal were most numerous in Grand Beach marsh. Numbers of other dabblers were low. A few black ducks (Anas rubripes) were seen in Netley-Libau and Riverton marshes. Only three American widgeon (Mareca americana) were seen throughout the survey; these were in Netley-Libau. Other species of dabbling ducks observed included pintail (Anas acuta), gadwall (Anas strepera), green-winged teal (Anas carolinensis), shoveler (Spatula clypeata) and wood duck (Aix sponsa).

Only two species of diving ducks were observed, lesser scaup (Aythya affinis) and redhead (Aythya americana). Highest number of the latter species occurred on Folster Lake.

Although Canada geese were observed in three of the marshes, no evidence was seen of breeding pairs. Some geese from the Interlake population nest on the western side of Lake Winnipeg.


LEGEND
NESTING COLONIES
19 Colony recorded on F.F. Slaney survey (1973)
13 Colony from literature sources
2 New colony - F.F. Slaney survey (1973)
Note: see Table
NESTING SPECIES
C Cormorant
P Pelican
T Tern sp.
Ct Caspian Tern
CT Common Tern
Ft Forster's Tern
Bt Black Tern
Hg Herring Gull
Fg Franklin's Gull
H Great Blue Heron
Wg Western Grebe
WATERFOWL HABITAT CAPABILITY
■ Class 2S or 3S (ARDA)
▨ Class 3M (ARDA)
Source: ARDA, 1969
DUCK SURVEY FLIGHT LINE
Flight line, June 6, 1973
See map insert
N
Nelson R.
Norway House
Playgreen Lake
Grand Rapids
Long Point
L
A
K
E
W
Poplar River
Reindeer Island
St Martin Islands
Sturgeon Bay
Kinwow Bay
Berens River
D
16 Ct
15 Ct CT Hg
14 C
17 C
13 C
12 C P T
11 C P Ct
10 C P T
9 C
8 C
7

MAP 1
WATERBIRD NESTING COLONIES
CLASS 2 & 3 WATERFOWL HABITATS (ARDA)
WATERFOWL SURVEY FLIGHT LINE
LAKE WINNIPEG - MANITOBA

LAKE WINNIPEG,
CHURCHILL AND NELSON RIVERS
STUDY BOARD
Winnipeg Manitoba

Project No. M25

F.F. SLANEY & COMPANY LIMITED
Environmental Resource Consultants

WATERBIRD NESTING COLONIES
CLASS 2 & 3 WATERFOWL HABITATS (ARDA)
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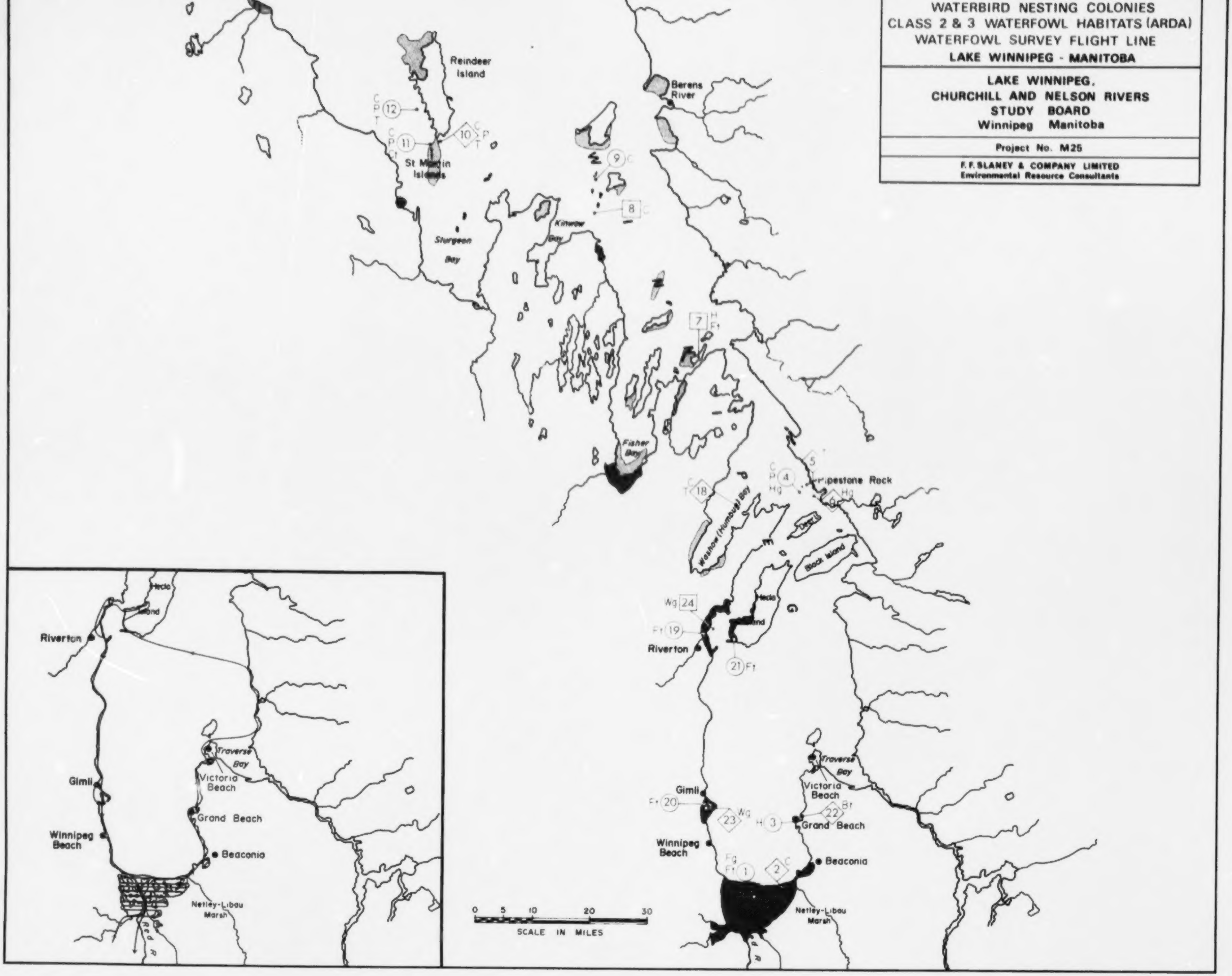

Reindeer Island
Berens River
C P T 12
C P Ct 11
10 C P T
St Martin Islands
9 C
8 C
W
Sturgeon Bay
Kinwow Bay
7 H Ft
Fisher Bay
5 T
C P Hg 4
Pipestone Rock
6 Hg
C T 18
P
Washow (Humbug) Bay
E
Deer
Black Island
Wg 24
Ft 19
Hecla Island
G
Riverton
21 Ft
Traverse Bay
Victoria Beach
Gimli
Ft 20
23 Wg
H 3
22 Bt
Grand Beach
Winnipeg Beach
Fg Ft 1
2 C
Beaconia
Netley-Libau Marsh
Red R
0 5 10 20 30
SCALE IN MILES
Riverton
Hecla Island
Traverse Bay
Victoria Beach
Gimli
Grand Beach
Winnipeg Beach
Beaconia
Netley-Libau Marsh
Red R

TABLE 5

BIRDS PER FLIGHT MILE*

LAKE WINNIPEG MARSHES - JUNE 6, 1973

SPECIES	Netley Libau	Folster Lake	Beaconia	Grand Beach	Victoria Beach	Hecla Island	Riverton	Willow Point	Unadjusted Averages
Canada Goose		0.58				0.64	1.33		0.33
Mallard	2,70	6.52	18.24	6.15	2.14	6.57	3.71	2.39	4.24
Black Duck	0.01						0.11		0.03
Pintail	0.08	0.14		0.19		0.64	0.27		0.16
Blue-winged Teal	1.06	2.03		5.38	2.14	3.79	0.98	0.80	1.46
Gadwall	0.39	2.90		0.77		0.70			0.39
American Widgeon	0.04								0.02
Green-winged Teal	0.07	0.29				0.29	0.04	0.23	0.10
Shoveler	0.07	0.29							0.05
Wood Duck	0.04	0.43						0.11	0.05
Lesser Scaup	0.24	0.29	0.15			0.36	0.15	0.23	0.24
Redhead	0.34	1.59				0.14	0.04	0.11	0.28
Duck Sp.	0.04	5.80							1.37
American Coot	0.21	0.72					0.04	0.11	0.15
Western Grebe	3.51	2.46	0.59	0.38			3.78+	0.34	2.67
Red-necked Grebe		0.14							0.01
White Pelican	3.70		1.76		18.60			7.39	2.80
Double Crested Cormorant	0.08	0.87							0.08
Great Blue Heron	0.31		1.03		3.57	0.07	0.45	0.23	0.38
Black-crowned Night Heron	0.03						0.04	0.11	0.03
Sandhill Crane							0.30		0.05
Franklin's Gull							b		-
TOTAL WATERFOWL PER MILE	5.08	14.90	18.40	12.49	4.28	13.13	6.62	3.87	8.72
TOTAL BIRDS PER MILE	12.92	19.09	21.78	12.87	26.45	13.20	11.24+	12.05	14.89

*Based on 147 flight miles

+One large colony

TABLE 6

PAIRS* OF WATERFOWL PER FLIGHT MILE

LAKE WINNIPEG MARSHES - June 6, 1973

SPECIES	Netley Libau	Folster Lake	Beaconia	Grand Beach	Victoria Beach	Hecla Island	Riverton	Willow Point	Unadjusted Averages
Mallard	0.85	1.41	2.50	0.20		1.43	0.38	0.11	0.84
Black Duck	0.17						0.11		0.11
Pintail	0.08	0.14				0.14	0.15	0.11	0.10
Blue-winged Teal	0.09	1.27	0.15	1.54	0.36	0.21	0.42	0.57	0.31
Gadwall	0.27	0.85				0.14	0.27	0.23	0.26
American Widgeon	0.03						0.11		0.03
Green-winged Teal	0.04	0.14							0.03
Shoveler	0.04	0.14				0.14	0.04		0.05
Wood Duck	0.03	0.14						0.11	0.03
Lesser Scaup	0.12								0.06
Redhead	0.17	0.28					0.11	0.45	0.15
Duck Sp.	0.12		0.15			0.07	0.08		0.09
TOTAL	2.01	4.37	2.80	1.74	0.36	2.14	1.67	1.58	2.06

*Unadjusted figures

TABLE 7
PAIRS* OF WATERFOWL
NETLEY-LIBAU MARSH AND FOLSTER LAKE, MANITOBA
AERIAL SURVEY JUNE 6, 1973

SPECIES	Netley - Libau			Folster Lake		
	Pairs/Mile	Pairs/Sq.Mi.**	Estimated Total Pairs***	Pairs/Mile	Pairs/Sq.Mile	Estimated Total Pairs
Mallard	0.85	3.40	226	1.41	5.78	25.0
Black Duck	0.17	0.68	45			
Pintail	0.08	0.31	21	0.14	0.58	2.5
Blue-winged Teal	0.09	0.37	25	1.27	5.20	
Gadwall	0.27	1.10	73	0.85	3.47	22.3
American Widgeon	0.03	0.10	7			
Green-winged Teal	0.04	0.16	11	0.14	0.58	2.5
Shoveler	0.04	0.16	11	0.14	0.58	2.5
Wood Duck	0.03	0.10	7	0.14	0.58	2.5
Lesser Scaup	0.12	0.47	31			
Redhead	0.17	0.68	45	0.28	1.16	5.0
Duck Sp.	0.12	0.47	31			
TOTAL	2.01	8.00	533	4.37	17.93	62.3

*Unadjusted for visibility

**Transects (76.4 x .25 sq. mi., Netley-Libau; 5.9 x .25 sq. mi., Folster Lake)

***Total areas (43,000 acres, Netley-Libau; 2,800 acres, Folster Lake)

In the nine marsh areas surveyed, total breeding pairs of ducks per flight mile were 2.06. Mallard pairs were the most abundant (0.84) throughout all areas surveyed, while American widgeon, green-winged teal and wood duck pairs were least common.

Townsend (1969) states that there were 23.2 breeding pairs per mile of shoreline in Netley-Libau marsh area in 1965 (based on a Folster Lake survey), up from 12.6 in 1961. These surveys were conducted by airboat. Transects flown in Netley-Libau and Folster Lake gave unadjusted pair counts per square mile of 8.00 and 17.93 respectively (Table 7). Surveys conducted by canoe in Folster Lake on June 7, 1973 revealed 26.3 waterfowl per mile of shoreline. The relationship, therefore, between aerial survey and canoe survey is a factor of 1:1.9. Low water levels during the canoe survey did not allow full count of birds. A ground survey conducted in the same area showed that waterfowl were present at 35 per shoreline mile. This figure would indicate that an index relating aerial and ground surveys would be a multiplication factor of 2.5. This factor compares favourably to 2.9, the average figure for six years given by Martinson and Kaczynski (1971) for Southern Manitoba. Total pairs throughout all marshes would, therefore, be approximately 5.2 per mile of shore and 20 pairs per square mile.

6.1.3.2 Staging

Accurate, consistent survey information is largely lacking for Lake Winnipeg, but enough flights have been flown since 1939 to indicate value of this lake to summer staging and moulting waterfowl is not as high at present as it has been in years of higher waterfowl populations and lower water. Flightless diver males, e.g., common goldeneye (Bucephala clangula) and lesser scaup, use the remote areas of the lake in significant numbers. Most valuable to these birds are bays where protection is adequate and food is abundant.

TABLE 8

WATERFOWL CENSUS*

NETLEY-LIBAU MARSH, 1973

(from Canadian Wildlife Service)

SPECIES	August 29	September 5	12	19	27	October 5	11	17	30
Whistling Swan								34	
Canada Goose			53	831	2221	976	60	275	2104
White-fronted Goose							27		
Lesser Snow Goose				114	67	602	1005		
Mallard	3533	1447	9822	4630	3109	5368	3216	5970	2948
Pintail	553	340	134	168	188	214		228	20
Dabblers sp.	2373	1181	5807	2855	1595	1567	416	1247	690
Lesser Scaup					2224	4945	1206	188	636
Redhead					3497	3591	221	322	100
Canvasback	127				536	80	27		127
Divers sp.	7	101		938	2372	6847	1755	47	
TOTALS	6593	3069	15816	9536	15809	24190	7933	8311	6625

* Total estimated from transect counts.

TABLE 9

WEEKLY AERIAL STAGING CENSUS (CWS)

LAKE WINNIPEG, 1972

Staging Area	Species	Aug.	September				October				TOTALS
		30	7	13	21	27	4	11	18	25	
Fisher Bay	Mallards	159	13	18	44	5	39	7	-	6	
	Other Ducks	136	31	56	69	58	205	41	182	81	
	Geese				267	173	138	252	96	34	
	Totals	295	44	110	380	236	382	300	278	121	2,146
Hecla	Mallards	1692	1243	150	936	2693	366	766	-	24	
	Other Ducks	958	1519	228	2536	2526	1695	1125	27	34	
	Geese	75	-	-	230	76	271	200	31	-	
	Totals	2725	2762	378	3702	5295	2332	2091	58	58	19,401
Kinwow Bay	Mallards	10	14	60	8	80	2	42	-	-	
	Other Ducks	-	35	8	396	20	997	56	32	30	
	Geese	48	24	2	224	104	48	76	-	-	
	Totals	58	73	70	628	204	1047	174	32	30	2,316
Netley-Libau Marsh	Mallards	557	484	842	692	483	770	522	953	191	
	Other Ducks	1291	430	435	510	717	1521	753	409	111	
	Geese	133	78	224	67	69	4	22	-	-	
	Totals	1981	992	1501	1859	2005	2573	1302	1471	302	13,987
Riverton	Mallards	1485	216	150	309	1725	421	1744	22	57	
	Other Ducks	2600	3640	461	1053	1469	-	-	-	-	
	Geese	46	200	108	5	686	94	8	61	94	
	Totals	4131	4056	719	1367	3880	1363	3495	767	458	20,236
Sturgeon Bay	Mallards	91	58	73	256	155	244	150	55	14	
	Other Ducks	45	213	98	356	356	916	820	561	386	
	Geese	30	65	37	328	424	172	346	167	201	
	Totals	166	336	208	940	935	1332	1316	783	601	6,617
Washow Bay	Mallards	257	110	192	370	674	218	307	9	22	
	Other Ducks	336	596	142	567	277	978	479	67	79	
	Geese	57	68	214	280	635	172	48	10	32	
	Totals	650	774	548	1217	1586	1368	834	86	133	7,196
Willow Point	Mallards	51	19	24	61	73	41	102	3	48	
	Other Ducks	113	458	99	153	89	497	339	392	169	
	Geese	-	-	-	205	20	-	-	-	-	
	Totals	164	477	123	419	182	538	441	415	217	2,976

* Actual numbers seen, not adjusted to an area basis

Numbers of dabblers have been estimated to exceed 40,000 in Netley-Libau marsh during years of attractive, lower water levels. Surveys conducted in 1957 revealed 14,000 ducks present in Riverton marshes. Young ducks have been found in Netley-Libau marsh during the summer from as far away as Minnesota (Townsend 1969). Adult blue-winged teal gather in the fringes of the marsh in August.

As early migrants leave, high numbers present in August begin to diminish by early September. With arrival of fall flights, numbers of waterfowl usually peak in late September and early October on the marshes. On Netley-Libau 41,000 ducks were counted in late October, 1969 (Townsend 1969). These ducks, mainly mallards, used the marsh while field-feeding several miles away. Numbers of waterfowl in Netley-Libau marsh peaked in the first week of October, 1973, but only 24,190 were seen (Table 8).

Large flocks of Canada geese begin to appear in early September (Table 9) and collect in Washow Bay, Fisher Bay, Riverton and Sturgeon Bay marshes. As the Interlake population of the giant Canada goose (_B_._c_. _maxima_) increases, these areas will become more important as staging areas (Townsend 1969).

Snow geese (_Chen caerulescens_) use the marshes and bays along Lake Winnipeg occasionally in large numbers. Migration stopovers depend to a great extent on weather (Hochbaum 1967). Several thousand of these birds have been observed in certain years (Townsend 1969).

6.1.3.3 Waterfowl Hunting

Marshes on Lake Winnipeg have been important to waterfowl hunters in Manitoba largely because of their high fall populations and close proximity to Winnipeg. Winnipeg hunters comprise almost half of the waterfowl hunters in the province. Total kill of migratory waterfowl by 41,133 Manitoba hunters in 1972 was 420,980 (Cooch et al. 1973). The number of sport hunters in Manitoba has dropped 10-20% since the 'sixties. Hunting pressure is generally correlated to waterfowl populations.

Harvest of geese (mainly Canadas) has risen steadily to nearly 65,000 in 1972. This kill is a ten-fold increase over the 'fifties. Approximately 12% of these geese are giant Canadas from the Interlake region (DMREM unpublished), and usually (depending on year) 5% are snow geese. Kill statistics and hunter success rates for 1971-72 were presented on pages 48 and 49, Report No. 2 - Southern Indian Lake. At the time of writing, the only information available on the 1973 season was that number of hunters had increased slightly (4% over 1972); no harvest statistics were available.

Netley-Libau marsh has traditionally been a favourite hunting spot for Winnipeg waterfowlers. Many hunting camps dot the marshes shorelines. Harvests are highest in the early part of the season, generally a mixture of dabbling ducks and resident "divers". Blue-winged teal are well represented in hunters' bags before their departure in the first week of October. Diving ducks, predominately lesser scaup and mallards, are shot in greater numbers as the season progresses.

6.1.4 Colonial Nesting Birds

Several species of waterbirds have established colonial nesting sites on the reefs, islands and in marshes of Lake Winnipeg (Map 1). These birds include the white pelican (*Pelecanus erythrorthynchos*), double-crested cormorant (*Phalacrocorax auritus*), great blue heron (*Ardea herodias*), western grebes (*Aechmophorus occidentalis*), and several species of gulls and terns (Laridae).

6.1.4.1 White Pelicans

The breeding range of the white pelican in Canada coincides closely with the 32°F. isotherm in April. Extent of the breeding range is largely determined by food supply. The total nesting population of this species in Canada was estimated to be 30,000 birds in 1968-69, 48% of these birds were in Manitoba, 6% on Lake Winnipeg (Vermeer 1970a).

White pelicans were observed in four separate colonies in 1973 (Table 10). Three of these colonies had been previously recorded by Vermeer (op. cit.). A colony found near Reindeer Island (Map 1) had not been noted in the literature. This was a small colony on a large reef covered with gravel and sand.

Numbers of pelicans in the St. Martin's colonies appear similar to Vermeer's 1970 estimates. Birds were nesting on all three islands (Photo 14 and 15). The small colony near Reindeer Island (No. 12) would also appear to be slightly reduced. The appearance of birds at the new site (No. 10) near Reindeer Island, may indicate a shift in nesting location from nearby islands. The new site appeared close to water level and probably unusable in high water years. The colony at Pipestone Rock (No. 4) appears to have increased since observed by Vermeer (1970a). Approximately 490 young were counted at the colony on July 22, 1973 (Photos 16 and 17). Vermeer (ibid.) reported 200 nests at this site.

TABLE 10

DESCRIPTION OF WATERBIRD COLONIES, LAKE WINNIPEG

SPECIES	LOCATION	NO. ADULTS	NO. NESTS	NO. YOUNG	AGE UNKNOWN	INFORMATION SOURCE	REMARKS
White Pelican	(4) Pipestone Rock 51° 22' N 96° 32' W	ca 90	ca 200	490		Vermeer (1970) Slaney (1973)	5 separate "rocks." Main rock had 80% of birds observed July 22/73. Pelicans on all 5 islands.
	(10) Reindeer Island 52° 16' N 97° 58' W	5-6		45		F.F. Slaney (1973)	large reef covered with gravel and sand.
	(11) St. Martin Islands 52° 15' 98° 01'	ca 135	670	540		Vermeer (1970) F.F. Slaney (1973)	3 small reef-like islands, 2 small sandy reefs. Two larger islands had 96% of pelicans.
	(12) Reindeer Island 52° 19' N 98° 2' W		29	12-20		Vermeer (1970) F.F. Slaney (1973)	small gravel reef
Double-crested Cormorant	(2) Folster Lake	ca 200				F.F. Slaney (1973)	in trees on sand/mud channel leading into marsh.
	(4) Pipestone Rock 51° 22' N 96° 32' W	120	260	200		Vermeer (1969) F.F. Slaney (1973)	on 2 of 5 islands shared with pelicans.
	(8) Nut Island Reef 52° 05' N 97° 21'		8			Vermeer (1969)	small reef.
	(9) John's Island 52° 09' 97° 20'		7			Vermeer (1969)	small reef.
	(10) Reindeer Island 52° 16' 97° 58'				75	F.F. Slaney (1973)	large reef - shared with pelicans.
	(11) St. Martin Islands 52° 15' N 98° 01' W	ca 140	407	360	50	Vermeer (1969) F.F. Slaney (1973)	90% on 1 large island. Remainder on 1 smaller island.
	(12) Reindeer Island 52° 19' N 98° 02' W		72			Vermeer (1969)	small reef shared with pelican.
	(13) George Island 52° 48' N 97° 35' W		70		190	Vermeer (1969)	small reef.
	(14) George Island 52° 52' N 97° 46' W		82			Vermeer (1969)	2 small reefs.
	(17) Poplar Point 52° 57' N 97° 14' W		5			Vermeer (1969)	1 small reef.
	(18) Washow Bay 51° 18' N 96° 48' W				15-30	F.F. Slaney (1973)	2 small gravel reefs.
Great Blue Heron	(3) Grand Beach 50° 32' N 96° 36' W		16			Vermeer & Hatch (1972)	island in marsh.
	(7) Matheson Island 51° 42' N 96° 55' W		26			Vermeer & Hatch (1972)	in marsh at edge of of island.

TABLE 10 (CONT'D.)

SPECIES	LOCATION	NO. ADULTS	NO. NESTS	NO. YOUNG	AGE UNKNOWN	INFORMATION SOURCE	REMARKS
Caspian Tern	(11) St. Martin Islands 52° 15' N 98° 1' W		490		ca 850	Vermeer (1970) F.F. Slaney (1973)	200-300 terns on each of 3 larger islands.
	(15) Little George Island 52° 52' N 97° 46' W		510 1000			Vermeer (1970) Vermeer (1972)	wooded island with sandy beaches.
	(16) Little Sandy Island 52° 58' N 97° 58' W		535			Vermeer (1970)	small reef.
Common Tern	(15) Little George Island 52° 52' N 97° 46' W		700			Vermeer (1972)	shared with Caspian terns.
Forster's Tern	(1) Netley-Libau 50° 21' N 96° 48' W		38			Hatch (1972)	small islets of vegetation in marsh.
	(7) Matheson Island 51° 42' N 96° 55' W		17			Hatch (1972)	
	(19) Riverton 51° 01' N 96° 57' W		ca 27			Hatch (1972)	nest sites in marsh.
	(20) Willow Point 50° 58' W		ca 100			Hatch (1972)	marsh.
	(21) Hecla Island 51° 0' N 96° 52' W		ca 40			Hatch (1972)	marsh.
Black Tern	(22) Grand Beach 50° 32' N 96° 36' W	40				F.F. Slaney (1973)	marsh.
Tern sp.	(5) Pipestone Rock 51° 23' N 96° 31' W	ca 200				F.F. Slaney (1973)	sand spit isolated from shore.
	(10) Reindeer Island 52° 16' N 97° 58' W	ca 400				F.F. Slaney (1973)	sand/gravel beach near pelicans.
	(12) Reindeer Island 52° 19' N 98° 2' W	ca 300				F.F. Slaney (1973)	gravel reef.
	(18) Washow Bay 51° 18' N 96° 48' W	unknown				F.F. Slaney (1973)	two small gravel reefs.
Herring Gull	(4) Pipestone Rock 51° 22' N 98° 2' W	ca 300				F.F. Slaney (1973)	2 large islands shared with pelicans and cormorants.
	(6) Near Pipestone Rock 51° 21' N 96° 31' W	ca 800				F.F. Slaney (1973)	3 low, rocky islands.
	(15) Little George Island 52° 52' N 97° 46' W		150			Vermeer (1972)	wooded island shared with terns.
Franklin's Gull	(1) Netley-Libau 50° 21' N 96° 48' W	ca 60				Hatch (1972) F.F. Slaney (1973)	raised marsh vegetation.
Western Grebe	(23) Willow Point 50° 35' N 96° 58' W	unknown size				F.F. Slaney (1973)	small colony.
	(24) Riverton 51° 02' N 96° 56' W	ca 600				F.F. Slaney (1973) Caswell (pers. comm. 1974)	1 large colony and 2 sub-colonies

In 1973, the birds were also nesting on two small, rocky reefs nearby. Height of nests above lake level (713.9 ft asl on day of observation) was 6'-8' and 4'-6', respectively. On the primary nesting island, which had 80% of all young birds, pelican nests were a safe 12'-18' above water.

The most successful and enduring colonies appear to be those on the high, larger islands (Photo 16). Colonies on smaller, low reefs are probably transitory. Long term nesting success on the larger islands is undoubtedly higher.

On the same day as surveys of young were undertaken, adults were observed as singles and in small groups over the entire lake. At Pipestone, very few (90) were in attendance. During a substantial flight over Netley-Libau marsh, about 70 miles from Pipestone, 450-475 adults were seen, many of which were fishing in medium sized groups. Some adults were also seen in flight between the two locations. It appears possible that the Netley-Libau marsh is a prime fishing area for birds from the Pipestone colony.

6.1.4.2 Double-crested Cormorants

The breeding range of this species generally coincides with the southern boundary of the Canadian Shield. Highest nesting densities in Canada are found in the Lake Manitoba - Lake Winnipegosis areas. Of the total breeding population in Canada (6,500 pairs), 54.9% are found in this region (Vermeer 1973).

Three colonies described by Vermeer (1969) were located during aerial reconnaissance in July, 1973. Six of the colonies listed by this author were not found, but two new colonies were observed. The largest colonies are those at Pipestone Rock and St. Martin Islands. Vermeer (1969) lists the number of nests recorded at these two areas as 260 and 407 respectively. In July 1973, counts at these islands yielded totals of 120 and 140 adults, and 200 and 360 young respectively. At both of these colonies, cormorants were observed on fewer islands than white pelicans. Nesting sites were usually as high as possible on the islands; eggs were laid on old sticks and roots (Photo 18). One colony in Netley-Libau marsh (No. 24) was comprised of tree nests. Only 6.3% of all nests recorded by Vermeer (1970a) were in trees.

Two new colonies, No. 10 Reindeer Island and No. 18 Washow Bay (Map 1) had 75 and and 15-30 young respectively. Colony 10 was a large reef shared with pelicans, while colony 18 was two small, gravel reefs.

Populations of double-crested cormorants in central Canada have declined from 1951 to 1969 by approximately two-thirds (Vermeer 1969). This author estimated the total breeding population in Manitoba in 1969 was 10,000 pairs. He estimates that in 1972 this total had declined to 3,570 pairs (Vermeer 1973).

6.1.4.3 Great Blue Heron

Like the cormorant, breeding range of the great blue heron (Ardea herodias) lies south of the Canadian Shield. The greatest majority (30%) of the estimated 4,000 pairs occurs in the Lake Winnipegosis - Lake Winnipeg area (Vermeer 1973).

Vermeer and Hatch (1972) list only two heronries on Lake Winnipeg; these are at Grand Beach (16 nests) and at Matheson Island (26 nests). These heronries are considerably smaller than the average for the area (70.5 nests).

Heronries are usually in living trees standing on dry land. The most favoured tree species in the area is trembling aspen. Very rarely will herons nest on the ground (Vermeer 1973).

6.1.4.4 Larids

Caspian terns (Hydroprogne caspia) have been observed at three different sites in north-central Lake Winnipeg. Only one of these sites (Little George Island) is shared with common terns (Sterna hirundo). The number of Caspian tern nests doubled from 510 to 1,000 between 1969 and 1971 at this latter site (Vermeer 1970b; 1972).

Total number of Caspian tern nests at the three colonies in 1970 was 1,535. Total common tern nests was 700 in the Little George Island Colony (Table 10). Vermeer (1970b) states that the larger Caspian tern colonies are probably the largest in the prairie provinces.

Nest site selection by Caspian terns is usually in the sand on low beaches devoid of vegetation. Common terns nest further inland; vegetation is occasionally present at nest sites.

Forster's terns (Sterna forsteri) have been recorded in five small colonies in Lake Winnipeg (Table 10). The largest colony is in Willow Point marsh where an estimated 100 pairs nest. The colony in Netley-Libau is near a colony of Franklin's gulls (Larus pipixican). The Matheson Island colony is at the northeastern extremity of this species' range (Hatch 1972).

Forster's terns typically nest on muskrat houses, on mats of year-old vegetation and platforms of fresh vegetation; the latter type is not common (Hatch op. cit.).

Black terns (Chlidonias niger) were recorded in one small colony (40 adults) at Grand Beach marsh. This species has nesting habits similar to Forster's tern.

A small colony of herring gulls (Larus argentatus) was recorded at Little George Island by Vermeer (1972). One hundred and fifty nests were counted on the island. No other colonies of this species were recorded during flights in June or July by F.F. Slaney personnel. Herring gulls usually nest with other species on islands among boulders, in sparse or no vegetation (Godfrey 1966).

Two colonies of Franklin's gulls were observed on Lake Winnipeg. A large colony in Riverton marsh (No. 19) contained approximately 525 pairs. A smaller colony in Netley-Libau contained approximately 30 pairs. This species typically builds its nest of floating vegetation in marshes.

6.1.4.5 Other Species

Two colonies of western grebes (Aechmophorus occidentalis) were observed in Willow Point and Riverton marshes. The colony in Willow Point was small; no estimate was made of numbers of birds. The colony in Riverton marsh is actually one large colony with two small subcolonies. There are approximately 300 pairs in Riverton marsh (Dale Caswell pers. comm.).

Western grebes typically build floating nests in extensive areas of bulrush or cattail, but occasionally these birds will nest on dry land (Vermeer 1958).

6.2 LOWER CHURCHILL RIVER

6.2.1 Current Status of Important Wildlife Resources

This part includes sections on the current status of the major wildlife species which may be affected by the decrease in flows along the lower Churchill River.

6.2.2 Moose

Information available on moose (Alces alces) in the Lower Churchill River area suggests that environmental conditions are severe and populations consequently low.

6.2.2.1 Habitat

Suitable moose habitat is limited to the immediate shorelines of the Churchill River and lakes along the system. There is a narrow band of shrubs, mostly willow, along the shores of most lakes, particularly Fidler and Billard Lakes (Photo 2). River shorelines between the lakes from Missi Rapid to Fidler Lake are predominantly rocky and provide little suitable browse. Shorelines downstream from Fidler Lake are often ice scoured and may provide only a narrow band of shrubs. The forest cover, however, becomes increasingly sparse downstream from Fidler Lake and there are long stretches of unsuitable steep shoreline (Photos 5 and 6).

Upstream from Fidler Lake a forest of mature black spruce begins immediately behind the narrow shoreline fringe of vegetation. There are numerous small ponds, creeks and bogs in the area, but there is only a limited amount of browse associated with these. There are several marshy bays along the shores of the lakes, e.g., the south end of Fidler Lake.

There have been several recent forest fires in the region but these are not of great significance as little deciduous browse is produced. Post fire regeneration is often black spruce.

6.2.2.2 Distribution and Abundance

On the survey of August 4, 1973, seven moose were seen. Sightings were as follows:

SUMMARY OF MOOSE OBSERVATIONS

1 male	- southwest bay of Partridge Breast Lake on lake shore feeding, a low shoreline, beach-like with sedge/willow.
1 male	- southeast bay of Fidler Lake, 10-15 ft. offshore feeding on aquatics; a marshy bay with aquatics and sedge/grasses/willow, low shoreline, sediment
1 cow with young calf	- on Churchill River, 2-3 miles west of Billard Lake, in a small pocket of "marsh-type" shoreline on the river; both in shallow water feeding.
1 cow with young calf	- in a muskeg area, 50 yd. from a small pond several miles south of the Churchill River between Billard and Fidler Lakes; appeared to be browsing.

Moose were seen on shorelines where aquatic vegetation and shrub willow were available as browse. No moose were seen on the survey of August 9, 1973, (Map 2) covering the area between Billard Lake and the estuary.

The Churchill River downstream from Billard Lake has very low potential for moose as browse is limited and the forest cover sparse. The best moose habitat along the lower Churchill is found along the shorelines between Missi Rapid and Billard Lake. There have been reports of moose with calves on islands in Northern Indian Lake (Hochbaum 1969). These islands would isolate moose from predators.

No official rating of the area has been done under the Canada Land Inventory system. Most of the Churchill River between Missi Rapid and Billard Lake appears to fall into Class 5 of the C.L.I. capability rating scheme. This class describes habitat typical of the Precambrian Shield with moderately severe limitations to moose production. The area downstream of Billard Lake would fall into Class 6 with severe limitations to moose production. Potential carrying capacities of Classes 5 and 6 in Manitoba are 0.2 - 0.3 and less than 0.2 moose per square mile, respectively (Goulden et al. 1973).

6.2.2.3 Moose Hunting

There is little information on moose hunting along the Lower Churchill River. Trappers using the area may shoot some and fishermen on Partridge Breast Lake could take moose along shorelines in the summer. Access is generally poor for sport hunters and low densities do not generally warrant the expense of flying into the area.

6.2.3 Barren-ground Caribou

6.2.3.1 Migration Patterns and Habitat Preferences

The annual cycle of the barren-ground caribou (Rangifer tarandus) of the Kaminuriak Population involves extensive migrations from summer range on the tundra to winter range in the taiga. During the period June to October, caribou utilize the tundra in the Northwest Territories. Calving takes place in the spring and most of the population moves later to the taiga of northern Manitoba and Saskatchewan. The rut takes place from late September to the third week in October (Parker 1972).

During the fall migration (late October - early November) one segment of the Kaminuriak Population moves from calving and rutting grounds in the Territories south near the coast of Hudson Bay, turning west as the animals approach the Churchill River and moving through (or past) the northern portion of Southern Indian Lake to the wintering grounds northeast of Reindeer Lake (Parker 1972). Detailed studies of barren-ground caribou have not been undertaken in the Lower Churchill River area. No information is available which can show the proximity of the migration route to the Churchill River. Caribou may intermittently move quite close to the river, but do not cross it on their annual migration according to Parker (1972).

In the 1940's and 1950's barren-ground caribou migrated much further south into Manitoba (Howard 1970b). Some were recorded wintering as far south as South Indian Lake community and Nelson House. Parker (1972) has reviewed the historical data available and suggests that changes in migration patterns can be attributed to declining populations since the 1950's. The larger populations resulted in an extension of winter ranges to areas further south. Recent winter range limits appear to have been stable between 1960-68. Should populations increase in the future, barren-ground caribou might be expected to resume their former movement pattern, which would involve crossing the Churchill River.

Lichens and other plants in the Transition Zone Forest provide suitable winter forage for migrating caribou. Kelsall (1968) reports that in northern Saskatchewan and adjacent Northwest Territories, lichens make up about half the diet, along with Vaccinium spp.(22%), Carex spp. (13%), Ledum groenlandicum (8%) and Salix spp. (4%). Kelsall (ibid.) also mentions an apparent preference for sedges along lake margins in the winter. During the winter, caribou dig feeding craters to remove the snow cover and expose vegetation.

The region from Missi Rapid to Billard Lake may constitute the best winter caribou range. Shrub willow and sedges are found primarily along the shores of lakes and in several reaches of the river. The region below Billard Lake is characterized by only a narrow fringe of suitable vegetation.

A large sedge meadow fringed with shrub willow was seen north of the Churchill River just below Kirkness Rapids. Such an area is a potential feeding site for migrating caribou.

6.2.3.2 Caribou Hunting

Utilization of caribou by natives in the north has been opportunistic, fluctuating annually and linked to the winter distribution of the caribou population. In the early 1950's animals were killed by natives throughout northern Manitoba. Caribou were killed by Indians from Split Lake, Nelson House, Churchill and South Indian Lake (Parker 1972).

With reduced population size and limited southward penetration, the caribou kill has been much less. Parker (1972) states that Indians from Churchill have not recently hunted caribou.

Trappers along the Churchill could take caribou as the migration occurs near areas actively trapped but the number is undoubtedly small. One caribou was killed near Missi in 1973 (Alex Cumberland pers. comm.).

6.2.4 Polar Bears

6.2.4.1 Distribution and Habits

A population of polar bears (Ursus maritimus) inhabits the coastline of Hudson Bay. This species is classifed as endangered and is the subject of considerable interest and management effort. The total world population has been estimated at 12,000 - 20,000 of which 6,000 are thought to be in Canada (Nero 1971). An estimated 250 bears frequent the Cape Churchill region each fall in preparation for departure onto winter sea ice (Howard pers. comm.).

In most years bears approach the communities in the fall period and cause apprehension and in a few instances serious problems. Nero (op. cit.) states that 65 bears ventured within six miles of Churchill in 1969. Bears congregate in the area awaiting the formation of ice on which they can travel out into Hudson Bay and hunt for seals. Shore ice development at Cape Churchill appears related to the type and amount of ice created by the freshwater input of the Churchill River. It is during the period that polar bears spend on the shore waiting for ice development that a problem exists in the Churchill area. By mid-November ice has formed and bears move out into the Bay.

Polar bears may move a considerable distance inland in the summer (Nero op. cit.). The Churchill River estuary is used by some bears during this time. During the survey of August 9, 1973 (F.F. Slaney & Co.) a polar bear was seen swimming in the river about 3½ miles upstream from the south end of Murrier Island. There were several low gravel islands in the river at this point. Bears have been seen up to 100 miles from the coast, but rarely (Nero op. cit.).

6.2.4.2 Polar Bear Hunting

Approximately 50% of the total world kill of 1,300 polar bears is in Canada (Nero op. cit.). In Manitoba, the hunting of polar bears is restricted and numbers shot annually are not high. Sport hunting is not allowed at present.

Some problem bears are killed near Churchill area if other efforts to disperse them fail. Not more than 15 bears are shot annually in the province. Five were killed near Churchill in the fall of 1973 (Jack Howard pers. comm.).

6.2.5 Furbearers

6.2.5.1 Distribution and Habitat Relationships

Aquatic furbearer habitat is restricted mainly to shorelines of the Churchill River and lakes within the system. Marsh shorelines are not common and there are numerous rocky reaches (Table 2). Downstream from Billard Lake, potential for furbearer production diminishes.

Beaver (*Castor canadensis*) lodges were observed in several of the streams and ponds draining into the lower Churchill. Beaver extend into the Transition Zone between tundra and boreal forest but populations are small (van Zyll de Jong 1970). Aspen poplar, a favoured food species, is at the northern extremity of its range along the lower Churchill River.

Muskrats are dependent on marsh habitat for food and cover. Marsh is not common along the lower Churchill River, especially between Missi Rapid and Billard Lake. Several small streams entering the system have narrow bands of marsh vegetation but low densities of muskrats can be expected due to the stress of climatic extremes.

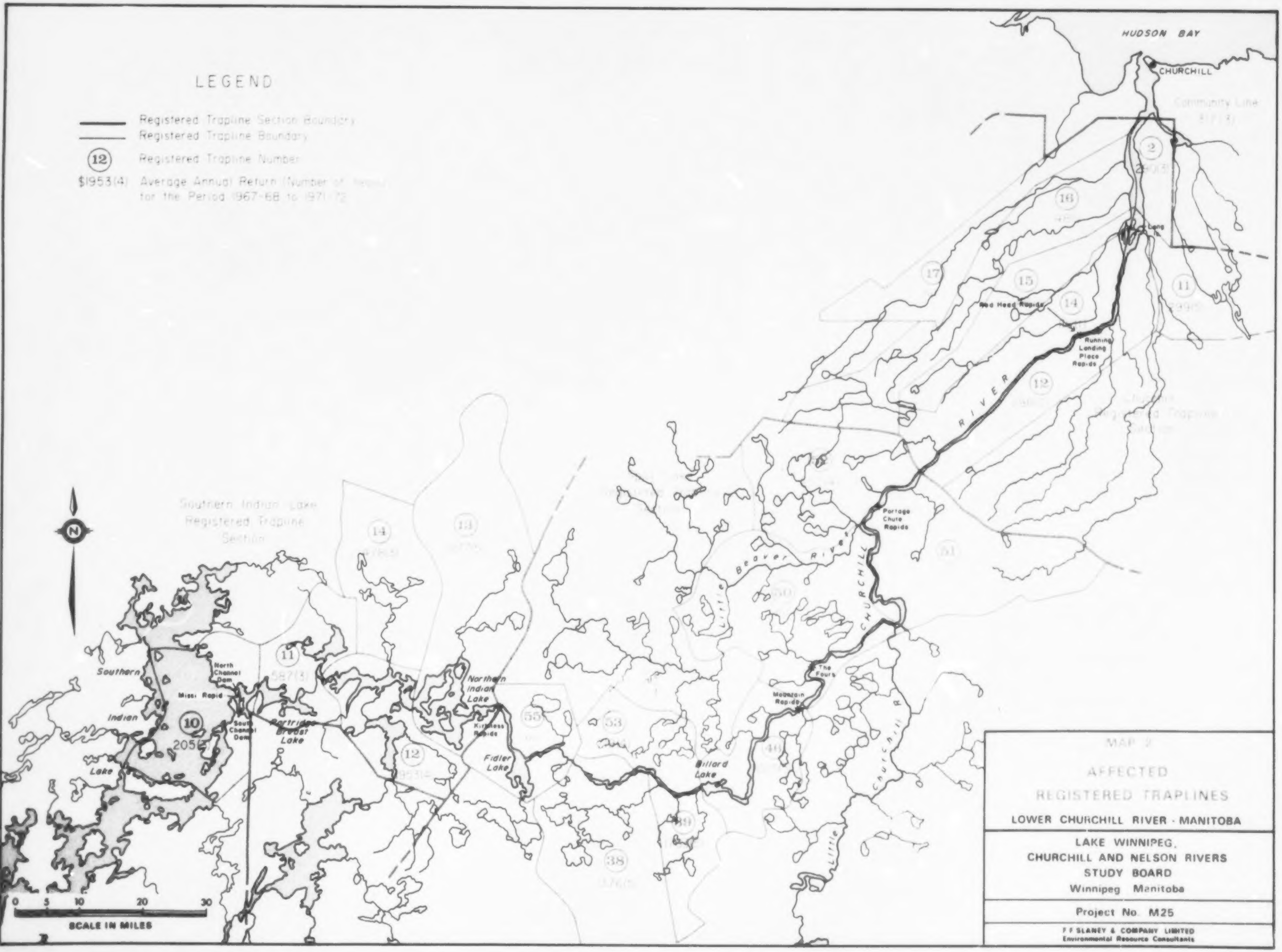
6.2.5.2 Fur Production

Registered Traplines along the lower Churchill River are organized into Southern Indian Lake, Split Lake and Churchill Sections (Map 2). Average annual fur harvest value from these RTL's during the period 1967-1972, was $9,340, compared with $23,934 and $60,753, respectively, from affected RTL's on Southern Indian Lake and the Rat-Burntwood Diversion (Appendix 12).

Returns from the Churchill Section accounted for only 9% of the total from all RTL's involved along the Lower Churchill River.

In the Churchill Section, fur returns for all species were low over the 1967/68 to 1971/72 period (Appendix 12). The RTL's in the Split Lake Section show fair production of beaver and mink, low muskrat production and very low numbers of lynx. Traplines within the Southern Indian Lake Section produced moderate numbers of beaver, few lynx and muskrat and fair numbers of mink. Harvests of mink declined in the past two seasons (Appendix 12).

Travel difficulties, long distances and low furbearer densities are probably responsible for the low production figures.


LEGEND
Registered Trapline Section Boundary
Registered Trapline Boundary
(12) Registered Trapline Number
$1953(4) Average Annual Return (Number of Years) for the Period 1967-68 to 1971-72
HUDSON BAY
CHURCHILL
Community Line
Churchill Registered Trapline Section
Southern Indian Lake Registered Trapline Section
RIVER
CHURCHILL
Churchill R
Little
Beaver River
Little
Running Landing Place Rapids
Red Head Rapids
Portage Chute Rapids
The Fours
Mosquito Rapids
Billard Lake
Fidler Lake
Kinosas Rapids
Northern Indian Lake
Partridge Breast Lake
North Channel Dam
South Channel Dam
Missi Rapid
Southern
Indian
Lake
2
16
17
15
14
11
12
51
50
46
53
55
38
39
13
14
12
11
587(3)
10
205(3)
0
5
10
20
30
SCALE IN MILES
N

MAP 2

AFFECTED
REGISTERED TRAPLINES

LOWER CHURCHILL RIVER - MANITOBA

LAKE WINNIPEG,
CHURCHILL AND NELSON RIVERS
STUDY BOARD
Winnipeg Manitoba

Project No. M25

F F SLANEY & COMPANY LIMITED
Environmental Resource Consultants

TABLE 11

FUR HARVEST VALUES OF AFFECTED RTL's ALONG THE LOWER CHURCHILL RIVER, 1967-68 to 1971-72

Year	Churchill Section	Split Lake Section	S.I.L. Section	Total
1967-68	$1,016	$3,536	$5,778	$10,330
1968-69	1,131	9,839	5,350	16,320
1969-70	1,023	5,974	2,144	9,141
1970-71	319	1,648	1,795	3,762
1971-72	592	3,615	2,943	7,150
AVERAGE	$ 816	$4,922	$3,602	$ 9,340

Source: DMREM Fur Dealer Returns, The Pas, Manitoba

6.2.6 Waterfowl

The lower Churchill River area is, for the most part, not highly productive of waterfowl when compared to the rich agricultural areas of southern Manitoba. Severe climate and lack of sufficient attractive breeding habitat are the major factors which usually limit production and presumably do so in this instance. Remoteness of the area, muskeg ponds and vegetation growing along ice-scoured banks attract significant numbers of Canada geese, however.

6.2.6.1 Production

A reconnaissance flight June 20, 1973 from Missi Rapid to Billard Lake revealed highest concentrations of waterfowl in the marsh areas east of Missi Rapid (Table 12). Waterfowl approached concentrations of 76 per shoreline mile (Table 13). The majority of these waterfowl (80%) were mergansers (*Mergus* sp.) in large flocks. Identifiable breeding pairs in the area were less than .1 per mile (Table 14). Concentrations of waterfowl in Partridge Breast Lake were low (.7 per mile), but evidence of .27 per mile of shoreline was gathered.

Waterfowl were concentrated between Northern Indian and Fidler Lakes at 23.6 per shoreline mile. Mergansers constituted 75% of the ducks counted.

Counts were low in all other areas, ranging from 0.5 birds per mile at Fidler Lake to 3.9 birds per mile between Fidler and Billard Lakes. Overall concentrations were 4.6 waterfowl per mile of river and lake shoreline surveyed. This figure compares to numbers found on Netley-Libau marsh, June 6. Elimination of non-breeding flocks of mergansers reduces this total to 1.4 waterfowl per shoreline mile (Map 3).

TABLE 12

BIRDS OBSERVED DURING AERIAL SURVEYS

LOWER CHURCHILL RIVER (SOUTHERN INDIAN LAKE - BILLARD LAKE)

JUNE 20, SEPTEMBER 28, 1973

	SECTION															
SPECIES	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	20/6	28/9	20/6	28/9	20/6	28/9	20/6	28/9	20/6	28/9	20/6	28/9	20/6	28/9	20/6	28/9
Whistling Swan		15						205				177		19		6/35*
Canada Goose	2	52		2			16	80	3	35	7	325	9	145	13	107
Snow Goose														5		
Mallard	4	207	4			75	31			25		20		25		
American Widgeon	3						2									
Black Duck										50						
Dabbler Sp.			2													
Lesser Scaup		268					19	200	20		3	175	2	5		4/345*
Common Goldeneye		15						70		12						
White-winged Scoter							5									
Scoter Sp.	63		25				4									
Diver Sp.	23	39	2				14		50				4	2		
Merganser Sp.	435	5			25		77		214		5		125	13	50	15
Duck Sp.	14	30	8		2		25	52	5	32	3	40	5	184		
Common Loon											1					
Herring Gull	3	15			1		7				3		43		2	
Bonaparte's Gull							1								4	
Common Tern	1		2				8				41		1		2	
Bald Eagle		1		2	2		1					3				
Common Raven	1						1									
TOTAL	549	647	43	4	30	75	211	607	292	154	63	740	189	398	71	132/380

* Two miles east of Billard Lake

SECTION:
1) Missi Rapid-Partridge Breast L.
2) Partridge Breast Lake
3) Partridge Breast L.-N.Indian L.
4) Northern Indian Lake
5) North. Indian L.-Fidler Lake
6) Fidler Lake
7) Fidler L.-Billard Lake
8) Billard Lake

TABLE 13
WATERFOWL OBSERVATIONS
LOWER CHURCHILL RIVER, MANITOBA
JUNE 20, SEPTEMBER 28, 1973

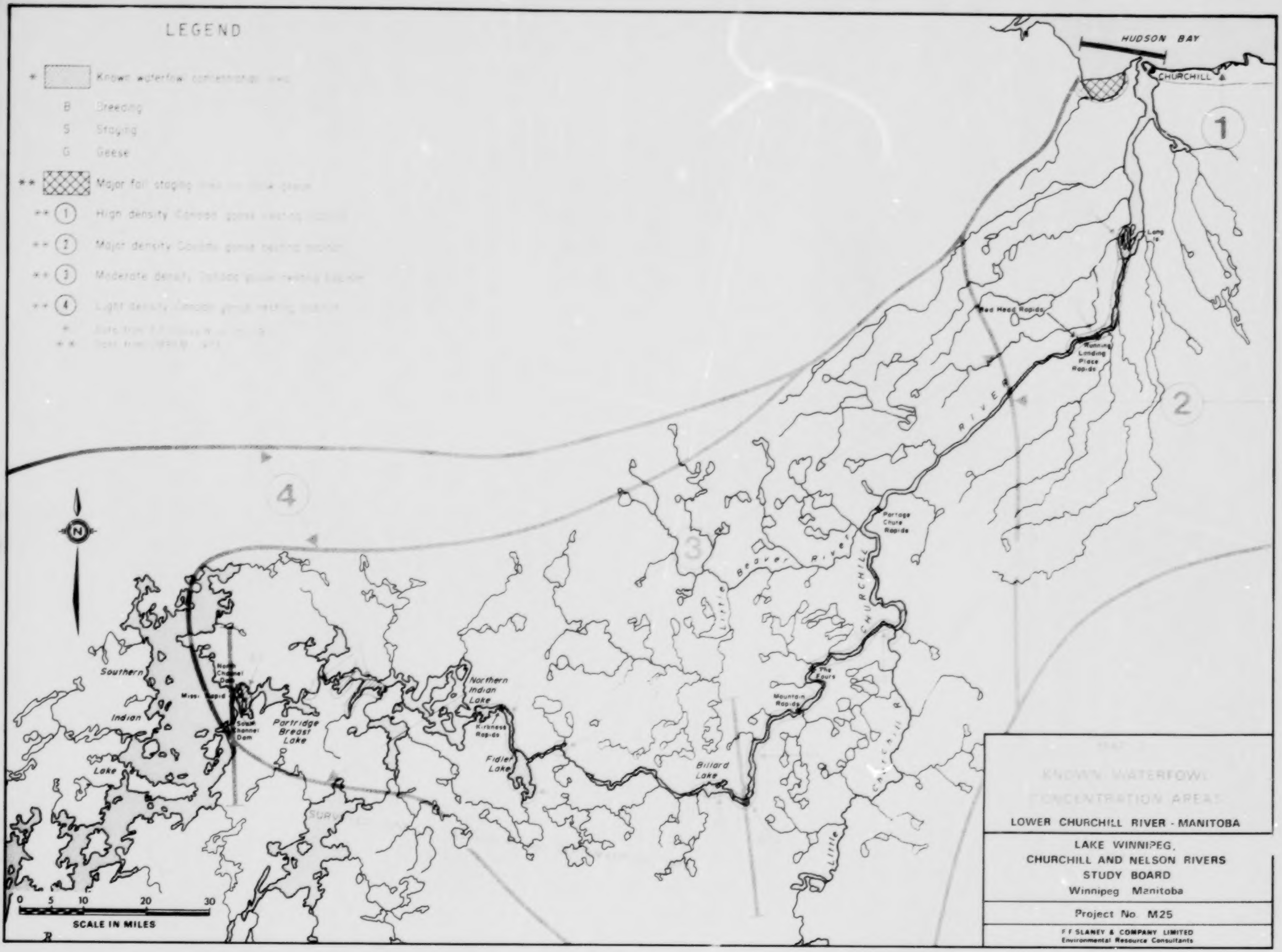
REACH	WATERFOWL PER FLIGHT MILE	
	June 20	September 28
Missi Rapid - Partridge Breast Lake	75.6	88.7
Partridge Breast Lake	0.7	0.03
Partridge Breast Lake - Northern Indian Lake	3.2	8.9
Northern Indian Lake	1.2	3.7
Northern Indian Lake - Fidler Lake	23.6	12.4
Fidler Lake	0.5	19.6
Fidler Lake - Billard Lake	3.9	10.6
Billard Lake	3.4	7.2/190.0*
TOTAL	4.6	9.6/10.8

* Marshes, two miles east of Billard Lake

Very little evidence of breeding waterfowl was gathered during the June flight. A total of 19 pairs of waterfowl (.09/mile) was observed from Missi Rapid to Billard. Mergansers and mallards were the most common species (Table 14). Areas with the highest concentrations of waterfowl are shown on Map 3.

Although 50 large Canada geese were observed, none was considered to be nesting, and no broods were seen. The actual river shorelines are apparently not heavily used breeding habitat, although nesting geese have been observed using marsh and island areas in lakes such as Northern Indian (Hochbaum 1969 and pers. comm.). Canadas do nest, however, in upland ponds and lakes adjacent to the river. Greatest numbers are on the tundra near its mouth. Raveling (1970) estimated the breeding population of Canada geese in a 20 mile wide strip from Missi Rapid to the Little Churchill River to be 1,724 pairs (.55 per square mile). Total production from these birds would be approximately 7,000 goslings (Raveling ibid.) Malecki (1974) reported finding only .2 - .3 pairs per square mile in the open and closed coniferous forests near the western reaches of the lower Churchill. Highest nesting density observed by Malecki was 5.8 pairs per square mile in tundra, south and east of Churchill.

Flights to gain information on use of the Churchill River by Canada geese were flown in fixed-wing aircraft and helicopter on August 4 and 9, 1973. Canada geese were observed during these flights at a rate of 1.1 birds per flight mile. A total of 18 broods was observed (Table 15). Highest concentrations of geese were in Billard Lake, from Billard Lake to the Little Churchill River, and from Red Head Rapids to Long Island. Occurrence of these geese was correlated with marsh areas and ice-scoured low banks (Table 16). Sigurdson (pers. comm.) reported seeing 40 non-flying Canadas on Partridge Breast Lake during early August, 1973. He also reported


HUDSON BAY
CHURCHILL
1
2
3
4
Long Is
Red Head Rapids
Running Landing Place Rapids
RIVER
Portage Chute Rapids
Little Beaver River
CHURCHILL
The Fours
Mountain Rapids
Little Churchill R
Billard Lake
Northern Indian Lake
Kirkness Rapids
Fidler Lake
Partridge Breast Lake
North Channel Dam
Missi Rapid
South Channel Dam
Southern Indian Lake
N
0 5 10 20 30
SCALE IN MILES

LEGEND

- * ▢ Known waterfowl concentration area
  - B Breeding
  - S Staging
  - G Geese
- ** ▨ Major fall staging area for snow geese
- ** ① High density Canada goose nesting habitat
- ** ② Major density Canada goose nesting habitat
- ** ③ Moderate density Canada goose nesting habitat
- ** ④ Light density Canada goose nesting habitat

* Data from F.F. Slaney & Co. [illegible]
** Data from [illegible]

MAP [illegible]

KNOWN WATERFOWL
CONCENTRATION AREAS

LOWER CHURCHILL RIVER - MANITOBA

LAKE WINNIPEG,
CHURCHILL AND NELSON RIVERS
STUDY BOARD
Winnipeg Manitoba

Project No. M25

F F SLANEY & COMPANY LIMITED
Environmental Resource Consultants

TABLE 14

PAIRS OF DUCKS PER FLIGHT MILE

LOWER CHURCHILL RIVER (SOUTHERN INDIAN LAKE - BILLARD LAKE), JUNE 20, 1973

	SECTION								
Species	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	TOTAL
Mallard		2(.11)*		3(.03)					5
American Widgeon				1(.01)					1
Dabbler Sp.		1(.05)							1
Lesser Scaup				1(.01)					1
Merganser Sp.	1(.09)		2(.24)	1(.01)		2(.10)			6
Duck Sp.		2(.11)	2(.24)			1(.05)			5
TOTAL	1(.09)	5(.27)	4(.48)	6(.07)		3(.16)			19(.09)

(1) - Missi Rapid-Partridge Breast Lake
(2) - Partridge Breast Lake
(3) - Partridge Breast Lake-Northern Indian Lake
(4) - Northern Indian Lake
(5) - Northern Indian Lake - Fidler Lake
(6) - Fidler Lake
(7) - Fidler Lake - Billard Lake
(8) - Billard Lake

* - Pairs (Pairs per flight mile)

TABLE 15

OBSERVATIONS OF CANADA GEESE

LOWER CHURCHILL RIVER (SOUTHERN INDIAN LAKE - HUDSON BAY), AUGUST 4, 9, 1973

	SECTION				
Geese	(1)*	(2)	(6)	(7)	(8)
Adults	2	8	6	11	10
Young	5	21	24	15	20
Unidentified					
TOTAL	7(.65)	29(1.61)	30(1.67)	26(.69)	30(6.25)
% Total	1.9	7.7	8.0	6.9	8.0
Broods	1(.09)	3(.17)	3(.17)	2(.05)	4(0.83)

	(9)	(10)	(12)	TOTAL
Adults	23	6	12	78(.23)**
Young	26		13	124(.37)
Unidentified	103	14	57	174(.52)
TOTAL	152(2.70)	20(0.63)	82(3.53)	376(1.13)
% Total	40.4	5.3	21.8	100 0
Broods	5(0.09)			18(0.05)

---

*Only those sections having geese are listed

**Geese per mile (based on total flight miles (332)through all sections)

(1) - Missi Rapid - Partridge Breast Lake
(2) - Partridge Breast Lake
(6) - Fidler Lake
(7) - Fidler Lake - Billard Lake
(8) - Billard Lake
(9) - Billard Lake - Little Churchill R.
(10) - Little Churchill R. - Portage Chute Rapids
(12) - Red Head Rapids - Long Island

TABLE 16

ASSOCIATION BETWEEN GEESE AND SHORELINES
LOWER CHURCHILL RIVER - AUGUST 4, 9, 1973*

Shoreline	Total Geese	%	Broods	%
1. Open Lake	22	5.8	3	15.8
2. Exposed bedrock with little marsh or beach development	32	8.5	4	21.0
3. Low shorelines with limited marsh and sedge/willow fringe	93	24.7	2	10.5
4. Low shorelines with marsh, sedges, grasses and willows present	131	34.9	8	42.2
5. Steep ice scoured beaches with little vegetation	20	5.3		
6. Low ice scoured beaches with sedges, grasses and willows	78	20.8	2	10.5
TOTAL	376	100.0	19	100.0

*Total flight miles - 332

seeing 15-20 Canadas which could barely fly one week later on Northern Indian Lake. Hochbaum (1969) observed 330 geese between Northern Indian and Fidler Lake in the summer of 1969. From Billard Lake to Mountain rapids he reported seeing 130 geese. This author states that most of these geese were probably non-breeders as few young appeared in the flocks. Bossenmaier reported a congregation of 5,000 geese on Fidler Lake in late summer (Raveling 1968).

During flights in early August, flocks of 2-300 diving ducks (mostly lesser scaup) were observed on the larger lakes. Sigurdson (op. cit.) also noticed these flocks. Hochbaum (op. cit.) reported "large rafts of diving ducks.......... scaup and goldeneye" on some of the lakes.

6.2.6.2 Staging

In late September, 1973, 3,116 waterfowl were observed between Missi Rapid and a point two miles downstream from Billard Lake (Table 12). Canada geese and whistling swans comprised 24% and 15% of all waterfowl observed. Dabbling ducks accounted for 13%, while diving ducks represented 36% of all waterfowl. Only 33 mergansers were seen during the flight, most of which were on the river between Fidler and Billard Lakes. Five snow geese were seen between Fidler and Billard Lakes.

Whistling swans were concentrated on Northern Indian, Fidler and Billard Lakes. Small flocks were observed also near Missi Rapid and on the river near Fidler and Billard Lakes. Canada geese were concentrated on Fidler and Billard Lakes. Small concentrations of mallards were observed east of Missi Rapid and throughout most of the area surveyed. Small staging flocks (100-200) of scaup were observed near Missi Rapid and on Northern Indian and Fidler Lakes. The marshy area east of Billard Lake had the largest number of scaup.

Flights in late October 1968 by the Canadian Wildlife Service revealed comparable numbers and species composition of ducks along the lower Churchill. No swans were observed and only small flocks of Canada geese were seen.

Snow geese appear to use the river to a limited extent in the fall. This species breeds in a small colony at La Perouse Bay, near Churchill. Concentrations of several hundreds of thousands from northern breeding areas collect along the coasts of Hudson and James Bay during their fall migration.

Canada geese which breed in the Hudson Bay Lowlands and along the Churchill River to Mountain Rapids (95^{o} 45' W) are primarily members of the Eastern Prairie Population of _Branta_ _canadensis_ _interior_, the Hudson Bay subspecies. Geese found west of Mountain Rapids are considered to be members of the Western Prairie Population. Attempts are currently being made by banding to define the limits of these sub-populations (Raveling pers. comm.). The geese are a large variety, highly prized by hunters and viewers of wildlife.

The tundra muskeg and river habitat east of the Little Churchill is the major segment of the nesting grounds of _B_. _c_. _interior_ (Pakulak 1969) although discontinuous muskeg around lakes with high shores and coniferous forests to lake edge offers scattered habitat to geese west of the Little Churchill River.

6.2.6.3 Waterfowl Hunting

The northern part of Manitoba receives less than 1% of the total waterfowl hunting pressure exerted annually in the province, and yet accounts for 3% of the duck harvest and 15% of the goose harvest. Total goose harvest in Manitoba in 1972 was 64,780 of which 73% were Canada geese (Cooch, Kaiser and Wight 1973).

Due to limited access and low concentrations, few Canadas are killed by sportsmen along the lower Churchill. Presumably those geese breeding from Missi to the Hudson Bay Lowlands remain to stage in that generally inaccessible region. Tundra geese from the Lowlands however, move to the coast and there are subjected to light to moderate hunting pressure.

Use of waterfowl by natives along the lower Churchill is not known but it can be considered minor and basically opportunistic, e.g. while fishing. Geese are probably taken in small numbers.

"Interior" geese stop over in central and southern Manitoba during the autumn. Raveling (1968) estimated the contribution to the harvest by _B_. _c_. _interior_ at approximately 65%. It is therefore an important goose to sportsmen of southern Manitoba.

6.2.7 Raptors

The only raptor observed during the surveys was the bald eagle (_Haliaeetus leucocephalus_). Three of these birds were seen in flights in late June, and six in late September. Presence of juvenile eagles in the area is indicative of some breeding success. Distribution of this bird is related to watercourses, as its major food is fish.

Several other raptors are known to breed in the area (Appendix 8).

6.2.8 Other Birds

Several species of gulls and terns breed in the area. Small colonies are present on lakes. One small colony of common terns was observed in Fidler Lake. A list of birds that possibly breed in the area is presented in Appendix 8.

6.3 THE RAT-BURNTWOOD DIVERSION

6.3.1 Current Status of Important Wildlife Resources

This part includes sections on the current status of the major wildlife species which may be affected by increased levels and flows along the Rat and Burntwood Rivers, following diversion.

6.3.2 Moose

The limited information available suggests that moderately severe environmental conditions and generally poor habitat combine to produce low populations of moose in the Rat-Burntwood Diversion Area. Certain locations, however, offer sufficiently good habitat to support medium moose densities of 0.4 - 0.6 per square mile.

6.3.2.1 Distribution and Abundance

All moose seen during summer surveys were along shorelines (Appendix 6), either on shore or feeding in beds of aquatic vegetation. A cow and two large calves were seen swimming in Karsakuwigamak Lake, which has predominantly bedrock shorelines. A cow and young calf were seen at the edge of the burn on Birch Tree Lake.

A winter aerial survey was flown to determine habitat used as winter range. Flight lines and transect blocks with moose sightings are shown in Appendix 6. No moose were seen along shorelines. Most were in deciduous areas with medium stocked poplar, birch and spruce or in lower deciduous drainage areas. Howard (1969) on his winter survey of Rat River, Granville Lake and Burntwood Lake areas, found that moose were mostly in upland habitat, characterized by young spruce, pine, birch, willow and alder growth. During the early winter period there appears to be an association with upland habitat (Howard op. cit.).

For a lengthy period before the winter survey of the present study, the weather had been severe. Temperatures had increased, however, just prior to the flights. During extreme winter conditions moose tend to remain in one small area. With warmer temperatures (-40°F to $+20^{\circ}$F) moose will move around more. Preferred habitat during cold periods is small upland draws where older stands of mixed conifers and deciduous trees and shrubs provide cover and food. Browse may quickly be depleted in these draws and with warmer weather moose may seek food in low drainage areas, with willow shrubs. On the winter survey numerous tracks were seen in such low lying, willow/shrub, inland areas. Moose had obviously been mobile during the few weeks prior to the survey.

During winter, highest densities were found in the region of the upper Rat River. The areas around Wuskwatim and Birch Tree Lakes appeared to be favourable winter habitat for moose but very few were seen. Also, tracks were not as frequent in these areas as in the Rat River region.

No concentrations of moose could be found and it is doubtful that any exist along the Diversion route. Densities presented in Table 17 were adjusted by visibility factors. The forest areas covered, particularly in the Wuskwatim and Birch Tree Lakes area (Transect Blocks IV and V), were fairly dense and moose were difficult to see.

As so few moose were seen on the survey it was impossible to define "winter ranges". Perhaps there are no winter concentration areas and moose randomly seek upland areas. Large areas of suitable winter range, i.e., mixed conifer and deciduous forest with abundant deciduous browse, were not seen on the survey.

TABLE 17
RAT-BURNTWOOD DIVERSION
WINTER MOOSE SURVEY, FEBRUARY, 1974*

	Transect Block	Transect Area (sq. mi.)	Moose Observed	Density	Adjusted Density
I	Upper Rat River	25.6	3	0.12	0.24**
II	Pemichigamau Lake	10	1	0.10	0.20**
III	Wapisu Lake	5	0	-	-
IV	Wuskwatim Lake	18	1	0.05	0.15***
V	Birch Tree Lake	11.2	0	-	-
	TOTAL A.+	69.8	5	0.07	0.16
	B.++	53.6	5	0.09	0.20

*See Appendix 6

**Adjusted for visibility factor of 2

***Adjusted for visibility factor of 3

+Density using data from all five transect blocks

++Density using data from transect blocks I, II, and IV only.

Compared with previous winter surveys, numbers of moose along the Diversion Route appear very low (Table 18). Populations may be decreasing in the area. Disturbance from construction activities may also have caused moose to leave the area, especially along the upper Rat River where construction activities are concentrated. Along the Burntwood River, from Threepoint Lake to Thompson, higher densities were expected. The area may be overhunted, thus depressing populations. Several of the previous surveys (Table 18) were also conducted in better habitat than found along the Diversion Route.

No official rating of the Rat-Burntwood Diversion area has been done under the Canada Land Inventory system. Most of the area however, would appear to fall into Classes 4 or 5 of the Canada Land Inventory capability rating scheme. Potential carrying capacities of Classes 4 and 5 in Manitoba are 0.4 - 0.6 and 0.2 - 0.3 moose per square mile, respectively (Goulden et al. 1973). Much of the Precambrian Shield region of northern Manitoba falls into Class 4 or 5. Exposed bedrock, poor soils and limited variety of landform appear to restrict ungulate production. The best moose habitat in Manitoba is found in the Saskatchewan River Delta where densities average one moose per square mile.

Goulden et al. (1968) estimated the potential carrying capacity of the Rat River area to be 0.75 moose per square mile. Howard (1970) made a generalized estimate of a density of 0.25 for northern Manitoba, including the Study Area. Average unadjusted winter densities from previous aerial surveys in three areas near, or in, the Study Area were 0.29 moose per square mile (Table 18). Adjusting conservatively for visibility factors, (two times actual observations), densities in those areas may average as high as 0.6 moose per square mile.

TABLE 18

WINTER MOOSE DENSITIES IN NORTHERN MANITOBA

(Moose per square mile - unadjusted aerial transect data)*

	YEAR												
Area	**'61**	**'62**	**'63**	**'64**	**'65**	**'66**	**'67**	**'68**	**'69**	**'70**	**'71**	**'72**	**'74**
Lynn Lake	.45	.45	.49	.43	.14	.18	.18	.18					
Thompson							.24	.18					
Granville Lake - Rat River									.20				
Outlet Lakes												.30	
Rat-Burntwood Diversion													.07

* Respective Sources: DMREM; DMREM; Underwood McLellan (1970); and F.F. Slaney (1973); Present study.

Although moose densities in some localities may be higher in winter, a density of between 0.25 and 0.5 moose per square mile for the Study Area appears to be a reasonable estimate. The region of the upper Rat River from Karsakuwigamak Lake to South Bay may have a density as high as 0.5. The area around Birch Tree Lake and Thompson may also have a density as high as 0.5 (Map 4). This area is classified as having a medium-heavy moose density on several maps (DMREM 1961, 1973). The rest of the Study Area was classified as light density. Low to medium densities appear to be found throughout the area. Poor quality of many of the burns in the area and hunting pressure may account for such densities.

6.3.2.2 Habitat

Goulden et al. (1968) suggest that moose habitat is significantly better along the Rat River than in surrounding areas such as Southern Indian Lake. Much of this attractiveness can be attributed to abundance of shrub willow along the upper Rat River and at other locations along the Diversion Route (Photos 9 and 11). Importance of this habitat type in determining the abundance of moose has been suggested by Bryant (1953).

Low shoreline types which have good willow growth are prevalent from Karsakuwigamak Lake to Issett Lake, on Birch Tree Lake and the north and southwest ends of Wuskwatim Lake (Tables 3 and 4).

The upper Rat River has a great deal of marsh shoreline (Table 3). Willow/alder type accounts for 13 - 22% of the vegetation types flooded along the upper Rat River and Issett Lake respectively (Forest Inventory data).

From Karsakuwigamak Lake to Split Lake, bedrock and bedrock-controlled shorelines or medium steep sediment shores predominate. These types of shoreline offer little attractive habitat to moose (Photo 12).

Recent burn areas are common in the Study Area (Appendix 6) and may be a significant factor in the distribution of moose. Forest fires have had little influence on the quality of moose habitat in northern Manitoba, however, as many burn areas return to spruce without deciduous regeneration (Bryant 1953). Forests on predominantly bedrock controlled areas are often bare of soil after a fire and consequently, cannot produce much deciduous growth. Examples of such burns are found south of Wapisu Lake and northwest of Notigi Lake. The only burn area which showed good deciduous regeneration is on Birch Tree Lake.

Moose eat submerged and floating aquatic vegetation when available, but availability and abundance of these plants are not of major significance in the distribution of moose (Bryant 1953). Marsh shorelines are found mostly along the upper Rat River and in bays of several lakes, notably Wuskwatim Lake. Water lily (Nuphar sp.) and pondweed (Potamogeton spp.) are found along such shorelines. The results of a moose browse survey are presented in Appendix 10. Browse plots were evaluated mostly along shorelines of burn areas (Photo 12) and marsh habitat. Willow appears to have been the only species used along shorelines. Aspen and alder were used in backshore areas. Evidence of browsing activity was infrequent throughout the survey except in part of the burn on Birch Tree Lake where there was good deciduous regeneration leading inland. Other plots along shorelines of burn areas showed adequate deciduous browse but no evidence of utilization (e.g., Plot No. 3, Photo 12).

Surprisingly, the willow communities along the upper Rat River were found to be only lightly used. There was little sign of moose activity along the shorelines surveyed by boat. All browsing on the survey appears older than the previous winter except for Plot No. 4 on Birch Tree Lake which was recent (a cow and calf were seen feeding in the area during field work).

6.3.2.3 Moose Hunting

Conservation Officers suggest that moose are harvested in the Study Area mainly by natives from Nelson House to provide meat and hides.

Moose are shot when available along trails and waterways throughout summer and fall. A portion of the harvest may be taken by fishermen along the shore during summer, such as at the southwestern part of Wuskwatim Lake (Appendix 6). Fall hunting parties take most of the moose shot along the Diversion Route.

Moose hunting is done in the summer and fall, along shorelines or rivers and lakes (Appendix 6). Trappers in winter seldom see moose and are not interested in shooting them. They sustain themselves on muskrat and beaver while trapping. The time and effort required to butcher the animal and transport it to Nelson House does not seem to warrant active moose hunting in winter.

Most moose are hunted near Nelson House and down the Burntwood River to Wuskwatim Lake and up the Rat River, sometimes to the upper Rat River (Map 4). The upper Rat River is too far from the community and travel by boat requires many portages.

Sport hunting has been previously confined to the area of the Burntwood River just eastand west of Thompson and in the Paint Lake area. In the past year the opening of the highway to Leaf Rapids has enabled sport hunters to enter the area and nine moose were killed (Appendix 6). Sport hunting is still somewhat restricted by limited transportation.

Moose kill locations by sport and native hunters were provided by local Conservation Officers (Chester Wishart pers. comm.) and are shown in Appendix 6. The total harvest in the map area is higher for the 1973 season than the previous year. In 1972 there were twenty-two moose shot (6 by sport and 16 by native hunters) and in 1973 thirty moose (14 by sport and 16 by native hunters). In the immediate area of the Diversion there were 6 kills recorded (3 sport and 3 native hunters) in 1972 and 13 (1 sport and 12 native hunters) in 1973.

The harvest of moose by Treaty Indians from Nelson House, as indicated from moose kill locations was about 16 for both 1972 and 1973. Interviews with trappers in the community and the Trapline Officer suggest approximately 13 to 16 kills annually as a minimum figure.

Assuming that only a portion of the kills by Treaty Indians was reported to the local Trapline Officers (perhaps 50%) then the total annual moose kill may be significantly higher than 16, as much as 25-30. Previous studies by Goulden et al. (1968), Welch et al.(1966) and Underwood McLellan (1970) gave no harvest estimates for the Study Area. An annual kill of 25-30 moose would be in the same order as the estimated 35 moose for South Indian Lake (F.F. Slaney 1974).

The Study Area lies within Provincial Game Hunting Areas (GHA's) 1, 2 and 9. Moose hunter questionnaire results from DMREM for the 1966 to 1972 hunting seasons are given in Table 19, for GHA's 1, 2 and 9. Moose kill locations (sport hunters) from the DMREM questionnaires indicate only 4 moose kills in the Study Area during 1970 and 1971, all in GHA 9 (See Appendix 6 for locations). Moose kills (sport and Treaty Indians) as reported to local Conservation Officers are also given in Table 19. Data are not available for comparable years.

GHA 1 provided 2.7% and GHA's 2 and 9 provided 2.7% and 4.9% respectively of the 1972 provincial moose kill.

TABLE 19

MOOSE HARVEST STATISTICS FOR LICENSED HUNTERS AND TREATY INDIANS RAT-BURNTWOOD DIVERSION AND TOTAL GHA'S 1, 2 AND 9 (1966 - 1973)

Year	Game Hunting Area 9		Diversion			Game Hunting Area 2		Diversion			Game Hunting Area 1		Diversion		
	Reported *	Estimated*	Reported **	Estimated ***	Reported +	Reported*	Estimated*	Reported **	Estimated***	Reported +	Reported*	Estimated *	Reported**	Estimated ***	Reported+
1966	13	159				18	174				10	133			
1967	43	550				22	257				4	61			
1968	15	154				11	109				2	28			
1969	21	244				3	17				5	73			
1970	8	82(±67%)	3	30		7	72(±71%)				6	62(±76%)			
971	9	104(±63%)	1	10		10	115(±60%)				7	81(±72%)			
972	14	132(±63%)R++ 28(±79%)NR++			3	15	73(±84%)R + 56(±55%)NR++			16	5	73(±84%)			
973	no data				15	no data				18	no data				

*DMREM Hunter Survey Reports
*DMREM Moose Hunter Questionnaires
*Based on a 10% sample
+Reported to Conservation Officers, from licensed hunters and Treaty Indians
+R = Resident hunter, NR = Non-resident hunter

for the 1973 season than the previous year. In 1972 there were twenty-two moose shot (6 by sport and 16 by native hunters) and in 1973 thirty moose (14 by sport and 16 by native hunters). In the immediate area of the Diversion there were 6 kills recorded (3 sport and 3 native hunters) in 1972 and 13 (1 sport and 12 native hunters) in 1973.

The harvest of moose by Treaty Indians from Nelson House, as indicated from moose kill locations was about 16 for both 1972 and 1973. Interviews with trappers in the community and the Trapline Officer suggest approximately 13 to 16 kills annually as a minimum figure.

Assuming that only a portion of the kills by Treaty Indians was reported to the local Trapline Officers (perhaps 50%) then the total annual moose kill may be significantly higher than 16, as much as 25-30. Previous studies by Goulden et al. (1968), Welch et al.(1966) and Underwood McLellan (1970) gave no harvest estimates for the Study Area. An annual kill of 25-30 moose would be in the same order as the estimated 35 moose for South Indian Lake (F.F. Slaney 1974).

The Study Area lies within Provincial Game Hunting Areas (GHA's) 1, 2 and 9. Moose hunter questionnaire results from DMREM for the 1966 to 1972 hunting seasons are given in Table 19, for GHA's 1, 2 and 9. Moose kill locations (sport hunters) from the DMREM questionnaires indicate only 4 moose kills in the Study Area during 1970 and 1971, all in GHA 9 (See Appendix 6 for locations). Moose kills (sport and Treaty Indians) as reported to local Conservation Officers are also given in Table 19. Data are not available for comparable years.

GHA 1 provided 2.7% of the provincial kill in 1972. GHA's 2 and 9 provided 2.7% and 4.9% respectively of the 1972 provincial moose kill.

A comparison of moose harvest data between GHA's 2 and 9 and that portion of each which lies in the Study Area ("Diversion") is presented in Tables 20 and 21. Accepting a moose density figure of 0.25 - 0.5 moose per square mile for the entire area, the population of each GHA and that portion in the Study Area have been estimated. A comparison of harvest rates (Tables 20 and 21) suggests that the area may be quite heavily hunted with a significant portion of the allowable harvest taken in the past few years. The calculated figures are, however, maximums. The actual harvest that is being taken is likely in the range shown for sport hunters or Treaty Indians (Tables 20 and 21) between 21% and 45%.

Considering present moose densities along the Diversion and the numbers shot annually, the area below Notigi is receiving high hunting pressure. The combined subsistence - sport harvest may be over acceptable levels. The information on moose kill locations from Conservation Officers suggests that 19% of moose killed by natives between Notigi and Thompson are calves. The actual percentage may be higher. Bryant (1955) suggests that in most areas near Indian communities the moose kill is not excessive but is poorly distributed in time and space, and takes too many calves. This may be the case for the area used by Nelson House hunters.

The area above Notigi receives less hunting pressure from sportsmen, except along the new road where construction workers and residents from Leaf Rapids have access. Moose harvests between Notigi and Karsakuwigamak Lakes are probably low. Disturbance from construction activities in this area is high and could account for the low numbers of moose seen in the area on the winter survey. Several of the trappers claimed that the area supports "large numbers" of moose. The lack of kill locations suggests that the upper Rat River is not heavily hunted by natives.

TABLE 20

MOOSE HARVESTS

RAT-BURNTWOOD DIVERSION AND TOTAL GHA 2

	GHA 2	Diversion
Area (approximate sq. mi.)	11,000	800 ++
Moose density index *	.25 - .5	.25 - .5
Estimated population	2,750 - 5,500	200 - 400
Allowable harvest (20%)	550 - 1,100	40 - 80
Estimated harvest - sport hunters	94**	20***
- Treaty Indian		17+
- Total harvest		37
Percent of allowable harvest - sport hunters	17 - 9%	50 - 25%
- Treaty Indian		43 - 21%
- Total		93 - 46%

*Composite index; from aerial surveys, previous surveys (See Table 18) and previous density estimates.

**DMREM Hunter Survey Reports (licensed hunters only) using averages for 1970 and 1971

***DMREM Moose Hunter Questionnaries

+Average moose harvest by Treaty Indians, as reported to Conservation Officers for 1972 and 1973.

++Approximate area of Diversion watershed within GHA 2.

TABLE 21

MOOSE HARVESTS

RAT-BURNTWOOD DIVERSION AND TOTAL GHA 9

	GHA 9	Diversion
Area (approximate sq. mi.)	9,500	400++
Moose density index*	.25 - .5	.25 - .5
Estimated population	2,300 - 4,750	100 - 200
Allowable harvest (20%)	475 - 950	20 - 40
Estimated harvest - sport hunters	93**	20***
- Treaty Indian		9+
- Total harvest		29
Percent of allowable harvest - sport hunters	20 - 10%	100 - 50%
- Treaty Indian		45 - 23%
- Total		145 - 73%

*Composite index; from aerial surveys, previous surveys (See Table 18) and previous density estimates.

**DMREM Hunter Survey Reports (licensed hunters only) using averages for 1970 and 1971.

***DMREM Moose Hunter Questionnaire

+Average moose harvest by Treaty Indians, as reported to Conservation Officers for 1972 and 1973.

++Approximate area of Diversion watershed within GHA 9.

6.3.3 Caribou

Barren-ground Caribou

Barren-ground caribou (*Rangifer tarandus groenlandicus*) have in the past utilized part of the Study Area as wintering range. When populations were high in the 1940's and 1950's, barren-ground caribou winter migrations penetrated areas south of their present winter range. In such years residents of Nelson House were known to hunt barren-ground caribou (Parker 1972). The Rat-Burntwood Diversion area contains potential winter range, characterized by black spruce forest with lichens and deciduous shrubs. (A more comprehensive discussion of barren-ground caribou can be found in section 6.2.3).

Woodland Caribou

The Rat-Burntwood Diversion area also represents potential woodland caribou (*Rangifer tarandus caribou*) range. Good quality habitat areas for these caribou feature mature black spruce and jack pine stands interspersed with upland bogs (Carbyn 1968). These areas contain a suitable mix of cover and food for critical winter periods. Food preferences include arboreal and ground lichens, various shrubs and sedges. Burned over areas usually do not support caribou populations in winter (Carbyn 1968).

The Diversion Route is at the northern extreme of woodland caribou range. Populations are higher in the Outlet Lakes area and have been discussed in a previous report (F.F. Slaney & co. 1973). Important calving grounds are in more southern areas. There is no information to suggest that woodland caribou use any part of the Study Area during the summer.

Evidence of woodland caribou activity was noted at the southern edge of Rat Lake on the winter survey flight of February 23, 1974 (F. F. Slaney & Co.). Numerous tracks were seen along the shore and a short distance out onto the lake. There was also evidence of "beds" on the ice.

There are also reports of caribou having been seen on Witchai Lake, (south of the Burntwood River and 12 miles southwest of the Kelsey Generating Station) in the winter of 1972/73 (Chester Wishart pers. comm.).

Woodland caribou therefore represent a potentially harvestable resource in the Study Area. Sport hunting of woodland caribou is permitted in the area. No estimate of harvest or potential harvest has been made.

6.3.4 Furbearers

In terms of both economic value and numbers, the major species trapped in the Rat-Burntwood Diversion area are beaver, lynx, mink and muskrat.

6.3.4.1 Distribution and Densities

Beaver

Beaver populations are associated with riparian habitat, providing suitable deciduous species for food and building material. Marsh vegetation is also preferred as several aquatic plants form a significant part of the beaver's diet (Nash 1951).

Shoreline type has little direct relation to the distribution of beaver in the Study Area. Beaver primarily inhabit small creeks, ponds and channels leading into the rivers and lakes along the Diversion. Lodges and dams were seen regularly on flights over the area, often extending far back from the shores of the Rat and

Burntwood Rivers. Interviews with trappers in Nelson House brought out the fact that most beaver are trapped in small streams, and seldom along the shorelines of the major lakes. Water flow is often too fast for beaver in the Rat and Burntwood Rivers.

Beaver may colonize some shorelines where there is suitable soil overburden and young deciduous growth, such as in recent burn areas. Bank burrows may be built in such a situation. One old beaver lodge was seen in such an area with deciduous trees and low profile, overburden shoreline, along the Burntwood River.

The Diversion lies in a region of medium to heavy beaver density (DMREM 1961). This is due to the relative abundance of suitable food trees, such as poplar and willow which are the principal sources of food and building materials in northern Manitoba. The high fur returns of the area (Appendices 13 and 14) reflect the high beaver populations. Densities may approach 1 lodge per square mile, with a probable range of 0.5 - 1.1 lodges, as quoted by Novakowski (1965) for a Precambrian landform with bog. This same author found 0.7 active lodges per mile of stream in northern Alberta and an overall density of 17 beaver per square mile. Normal winter survival was 79% in northern Alberta. In the Diversion area each lodge can house 7 to 8 beaver of which up to 3 or 4 may be trapped each year (Trapper interviews, Nelson House).

Lynx

Lynx are indirectly dependent on shorelines through the availability of prey species, primarily the snowshoe hare. The predatory nature of the lynx requires it to move over large areas. Most of the Study Area would be utilized to some extent by lynx. The more productive riparian habitats are preferred. Burn areas in early seral stages are also utilized.

The home range of the lynx is quite large. Saunders (1963b) found movements of tagged lynx ranging from 0 to 64 miles with an average of 2 miles and an average cruising radius of 2.6 miles. This same author found three home ranges of 6, 7 and 8 square miles. The physiographic nature of Saunders' (op. cit.) study area in Newfoundland is quite similar to Northern Manitoba.

In northern Alberta, Nellis et al. (1972) found an average home range size of 15 square miles. Winter density figures ranged from 0.05 to 0.19 lynx per square mile, paralleling a decline in the snowshoe hare population (Nellis et al. op. cit.). The number of lynx furs harvested also followed the same pattern of decline. The authors suggest that annual productivity of lynx appears to be directly related to the abundance of snowshoe hares. The cyclic nature of lynx furs produced has been reviewed by van Zyll de Jong (1971).

In Manitoba the area of greatest lynx abundance lies in the region between the Churchill and Nelson Rivers, including the Rat and Burntwood Rivers (van Zyll de Jong 1971).

Abundance of lynx has been quite high in the Study Area, as reflected by fur returns (Appendices 13 and 14). Lynx are trapped mostly in habitat adjacent to streams and other productive deciduous habitat (Trapper Interviews). From these interviews with trappers it appears that numbers of lynx are declining in the area and the trough of the 10-year cycle of lynx abundance may be near. Returns of lynx pelts have been declining. Maximum densities may have been reached several years ago, and may have been as high as 0.2 per square mile (Nellis et al. 1972).

Mink

Mink are semi-aquatic predators which favour deciduous woodlands and marshes surrounding banks of rivers, ponds, lakes and streams. Riparian habitat provides areas for dens and adequate numbers of prey species. The marshy, low willow shorelines and medium steep sediment-type are the most suitable shoreline types in the Study Area. Low bedrock shorelines along rivers and lake are also used. The upper Rat River from Karsakuwigamak to Issett Lakes is abundant in such good mink habitat. Several bank burrows were found during boat work in the area and evidence of mink feeding on shellfish was noted.

Mink have one litter per year of [illegible] young. In Montana, Mitchell (1961) found a complete turnover in population in three years. The same author found a home range size for males not to exceed a diameter of three miles.

Mink are found in deciduous habitat along creeks and ponds inland from the Rat-Burntwood Diversion system. Mink are trapped in riparian habitat along streams, ponds and lakes (Trapper Interviews).

The production of mink pelts also seems to be of a "cyclic" nature with a cycle of approximately 10 years reflected in the number of pelts (van Zyll de Jong 1970).

Muskrats

In terms of numbers of pelts harvested, muskrats are the most trapped species in the Study Area (Appendices 13 and 14).

Distribution of muskrats is directly related to marsh habitat. Muskrat habitat is limited in the Diversion area. Precambrian bedrock is predominant and extensive marsh areas few. There are numbers of small pocket marshes along most shorelines of lakes along the system. Rat Lake has predominantly bedrock-controlled shorelines but pockets of marsh are common, typical of many of the lakes. These pocket marshes usually exist in small embayments where a creek enters the lake, and provide suitable muskrat habitat.

Larger areas of marsh are found in Wuskwatim Lake, at the southern and northern ends. Numerous ponds and creeks inland from the main system also provide suitable muskrat habitat.

River shorelines are usually unsuitable as the current is too swift for muskrats. Several reaches of low shorelines on the Rat River where flows are not as swift have good potential for muskrat production. The upper Rat River between Karsakuwigamak and Issett Lakes and the reach between Rat and Missinagu Lakes are good muskrat habitat. Aquatic vegetation is relatively abundant in these reaches and shorelines are suitable for muskrats (Photo 7). Important winter foods such as horsetail, bulrush and pondweeds are present. Moderate densities were found in horsetail types in the Peace-Athabasca Delta (Ambrock and Allison 1973).

In the Rat River region, Bryant (1954) reported the following plants to be common and probably important to muskrats: common horsetail (Equisetum fluviatile), pondweeds and a sedge (Carex rostrata). He also reported another sedge, C. aquatilis, to be common: this species is regarded as important by Errington (1963). The region provides ample aquatic vegetation for food and building material for houses and "push-ups".

Muskrats are trapped in pocket marshes along rivers and lakes and in larger marshes in the Study Area. Ponds and creeks inland from the main system are also frequently trapped (Trapper Interviews).

Some areas are obviously under-utilized, such as the large marshes of Wuskwatim Lake. Harvest data for RTL's 4 and 47 indicate low numbers of muskrat pelts trapped in 1971/72 (44 and 64 pelts, respectively).

Other Furbearers

Other species trapped in the Rat-Burntwood Diversion area include otter (Lutra canadensis), fox (Vulpes spp.), pine marten (Martes americana), red squirrel (Tamiasciurus hudsonicus), wolf (Canis lupis) and wolverine (Gulo luscus). All of these account for only 5% of the total annual returns. Most furbearers in the group are land based, but may be indirectly dependent on shorelines.

Although black bears (Ursus americanus americanus) are considered to be of medium density in the area (DMREM 1961) this species is currently only lightly utilized. Only two black bear pelts have been recorded over the 1967/68 to 1971/72 period. Goulden et al. (1968) considered black bears as not being commerically utilized, except for the occasional pelt. Fur harvest data probably do not reflect the actual numbers of bears shot.

6.3.4.2 Fur Production

Furbearers in northern Manitoba are harvested under a registered trapline (RTL) system established in the 1940's. RTL's are assigned to individuals who often retain helpers during the trapping season.

Fur harvest data are collected by the Manitoba Government. Fur dealers in the Province annually submit a record of all furs purchased. This record goes to local Conservation Officers, then to regional headquarters (The Pas, for the Nelson House Registered Trapline Section) and Winnipeg.

The trapping season begins in the Rat-Burntwood area in late October and continues until May. Trapping of individual species is mostly in periods of the year when pelts are prime, e.g. muskrats, spring and fall; mink, early winter; lynx, mid-winter.

Animals are pelted both on the trapline and at the trapper's home. All subsequent pelt preparation after skinning is usually done by the trapper at home. Travel from communities to traplines is time consuming, and costly. RTL's near communities are utilized to a greater extent than remote RTL's, such as those northeast of Nelson House up to the Churchill River. Fish camps and cabins are used as bases by those trappers working remote traplines (Appendix 7).

Interviews with trappers from Nelson House brought out the following points of interest concerning trapping practices in the area.

- Trappers first go out in the fall, following the rivers and lakes to their traplines. Cabins are stocked, equipment readied and traps set out. Trappers return after the watercourse has frozen over and subsequently return to their lines for several weeks at a time throughout the winter.

- Areas trapped in winter on an RTL are mostly inland, following creeks and ponds. Lake and river shorelines are trapped in the spring after the weather breaks.

- Both the Rat and Burntwood Rivers are vital transportation routes for trappers. Most of the travel between the trapline and community is along the rivers but there are a few overland routes in winter. All travel in the fall is along the rivers.

- Traplines are generally either well used or not used at all. There are large numbers of non-active RTL's. Those RTL's which are trapped are covered by several trappers, unless a line is small enough to be worked alone. In larger lines such as #39 the area is split up among trappers (9 in the case of #39) so that most of the suitable habitat is trapped.

- Non-active RTL's are usually remote. Access is difficult and time consuming. In some years a group of trappers will get together and fly into one of the lines and trap for a period.

- Interest in trapping is declining. Returns in the latter part of this season are very poor. Some trappers are employed elsewhere and will not return to traplines until the weather breaks, if at all.

A community trapline near Nelson House is used by residents who do not have their own trapline. This trapline also serves as a recreational function for the Community. Recently, trapper organizations have been formed to facilitate better fur harvests and increase co-operation with government departments. The Nelson House Trapper's Association is among the most progressive in Manitoba.

Registered traplines affected by the Diversion route are shown in Appendix 7. This map also indicates average annual fur returns for each RTL, the location of trapper's cabins (Don Spence pers. comm.) and areas most actively trapped (information from interviews with trappers; not available for all RTL's).

The dollar return from the Nelson House Section fur harvest has declined in the last five years (Table 22). A record high of

TABLE 22

NELSON HOUSE REGISTERED TRAPLINE SECTION
FUR HARVEST RETURNS AND NUMBERS OF ACTIVE TRAPPERS
1967-68 to 1971-72

Year	All RTL's	Partially Affected RTL's*	% Value Affected RTL's	Total Active Trappers	Active Affected Trappers	% Active Trappers Affected
1967-68	$ 63,249	$ 31,673	50	113	63	56
1968-69	106,583	77,417	72	126	80	63
1969-70	58,880	41,369	70	112	77	69
1970-71	42,004	28,606	68	88	52	59
1971-72	49,264	36,187	73	88	59	67
AVERAGE	$ 63,996	$ 43,050	66	105	66	63

*Those RTL's partially affected by flooding along the Diversion Route. Degree of impact upon fur harvest returns will vary.

Source: DMREM Fur Dealer Returns, The Pas, Manitoba.

TABLE 23

NELSON HOUSE REGISTERED TRAPLINE SECTION
FUR HARVEST RETURNS FOR MAJOR SPECIES* 1967-68 TO 1971-72

	BEAVER			LYNX			MINK			MUSKRAT		
YEAR	All RTL's	Partially Affected RTL's*	%	All RTL's	Partially Affected RTL's	%	All RTL's	Partially Affected RTL's	%	All RTL's	Partially Affected RTL's	%
1967-68	$37,800	$19,026	50	$ 9,519	$ 4,627	48	$ 8,304	$4,048	49	$4,049	$1,883	46
1968-69	58,652	41,530	71	30,832	22,919	74	10,404	7,973	77	4,874	2,859	59
1969-70	30,324	21,698	71	19,530	13,260	68	4,823	3,419	71	2,224	1,874	84
1970-71	22,820	15,582	68	15,074	8,189	54	862	736	85	2,546	2,151	84
1971-72	22,140	15,894	72	14,737	11,587	74	2,296	1,676	73	5,714	4,261	74
AVERAGE	$34,347	$22,746	66	$17,938	$12,116	64	$ 5,338	$3,570	71	$3,881	$2,605	69
PERCENT	53%			28%			8%			6%		

*Those RTL's affected by flooding along the Diversion Route.

Source: DMREM Fur Dealer Returns, The Pas, Manitoba.

TABLE 24

TRENDS IN FUR HARVEST VALUES OF AFFECTED TRAPLINES

NELSON HOUSE REGISTERED TRAPLINE SECTION, 1967-68 to 1971-72

Year	No. of Active * Traplines	No. of Active ** Trappers	No. of Pelts*** Harvested	Value + (All Species)	Average Return per Active Trapline
1967-68	24	63	3,320	$31,673	$1,320
1968-69	29	80	4,741	77,417	2,670
1969-70	28	77	3,144	41,369	1,477
1970-71	22	52	2,917	28,606	1,300
1971-72	27	59	3,429	36,187	1,340
AVERAGE	26	66	3,510	$43,050	$1,621

Source: DMREM fur dealer returns, The Pas, Manitoba.

*Trapline with pelts harvested

**Minimum of one pelt harvested

***Four major species, total of beaver, lynx, mink and muskrat

+ Calculated using average prices paid at current year auction sales (R. Burns pers. comm.).

TABLE 25

FUR HARVEST RETURNS FROM AFFECTED RTL'S ALONG THE DIVERSION ROUTE OTHER THAN THOSE IN THE NELSON HOUSE SECTION, 1967-68 TO 1971-72

Year	S.I.L. Section	Split Lake Section	Thicket Portage Section	Pickwitonei Section	Total
1967-68	$3,365	$3,558	$790	$ 8,311	$16,024
1968-69	7,102	7,994	900	13,180	29,176
1969-70	5,362	3,354	697	9,777	19,190
1970-71	4,558	5,054	-	4,178	13,790
1971-72	2,812	4,639	-	2,887	10,338
					Average - $17,703

SOURCE: DMREM Fur Dealer Returns, The Pas, Manitoba.

$106,583 for recent years was set in 1968/69. In that season the beaver and lynx harvests were particularly high (Table 23).

Higher fur prices for the 1972/73 season (Appendix 11) may reverse the downward trend (no harvest data available for 1972/73). There is some correlation between the number of active trappers and the total annual return. The number of active trappers fluctuates annually, but does show a slight decline from 1967/68 (Table 24). The average annual return from active traplines has also declined (Table 24). Beaver provide 53% of the average annual harvest value, followed by lynx (28%), mink (8%), and muskrat (6%). Other species add the remaining 5% (Table 23).

The average annual return to the community of Nelson House from fur sales during the 1967/68 to 1971/72 period was $63,996. Approximately 66%, or an average of $43,050, was from RTL's in the Nelson House Section which will be affected by the Diversion route. Other RTL's from other Sections (Table 25) add an average annual return of $17,703 for a total of $60,753.

The areas most actively trapped in the Nelson House Section are shown in Appendix 7 (from trapper interviews; information not available for all RTL's). The areas provide most of the beaver, mink and muskrat.

The most productive traplines (average annual return over $2,000, Table 25) along the Rat-Burntwood Diversion are Nelson House RTL's 12, 30, 33, 39, 49, and 60; Southern Indian Lake RTL 4; and Pickwitonei RTL 57. Reasons for this may be species availability, proximity to the community, and better habitat. The majority (20 of a total of 40 affected RTL's) produce an average annual fur harvest return between $1,000 and $2,000.

6.3.4.3 Potential Fur Production

Fur production is influenced to a large degree by world market trends. At present, fur prices are higher than in the past few years; consequently fur returns should increase correspondingly in the 1972/73 season.

Government programs are being developed which will increase utilization of the resource through more intensive resource management practices and trapper education.

Some RTL's appear to be well utilized whereas others are obviously under utilized - for example RTL's 4 and 47. Remote RTL's are especially under utilized. Travel difficulties and lack of trapper motivation depress harvests. The availability of alternative employment also reduces trapper motivation.

6.3.5 Waterfowl

The Rat-Burntwood Diversion was divided into sections by lake and river reach (Map 4). Many of these sections have very little value to production of waterfowl due to steep, rocky or sediment shorelines and little marsh growth.

6.3.5.1 Production

During surveys in mid-June, only 538 waterfowl were seen along the entire route from Issett Lake to Split Lake. Nearly 90% of the birds were associated with marsh shorelines along Wuskwatim Lake, the upper Rat, and lower Burntwood Rivers (Table 26).

A total of five whistling swans was seen in Karsakuwigamak and Pemichigamau Lakes and the Burntwood River west of Split Lake. Only three Canada geese were seen; these were on the Burntwood River between Apussigamasi and Birch Tree Lakes. Two of these geese were considered to be a breeding pair.

Mallards and lesser scaup were almost even in numbers and together comprised 21% of all waterfowl observed. Diving ducks were twice as numerous as dabblers. The latter favoured marshy areas more than diving ducks. Other dabbling species included black ducks, American widgeon, pintail, green-winged and blue-winged teal. Diving ducks included common goldeneye and bufflehead. Both white-winged (Melanitta deglandi) and surf scoter (M. perspicillata) were observed in small numbers on Wuskwatim and Karsakuwigamak Lakes.

Only six species of waterfowl showed signs of breeding along the Diversion Route (Table 27). Overall, the number of pairs per flight mile was .09 with mallards the most abundant (.045 pairs per mile). Breeding birds were only observed in the upper sections of the Rat River and along the Burntwood River (and its lakes) from Threepoint to Split Lake.

TABLE 26
BIRDS OBSERVED
RAT-BURNTWOOD DIVERSION - JUNE, 1973

	SECTION*																										
SPECIES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	TOTAL
Whistling Swan			2			1																				2	5
Canada Goose																						3					3
Mallard	1	9	6			7											7				8	4	1	3	4	6	56
Black Duck																									1		1
American Widgeon			1			3																					4
Pintail																											
Green-winged Teal		4				1														2					1		8
Blue-winged Teal																	1										1
Dabbler sp.							1																			1	2
Lesser Scaup		7											2				16		15	1		17					58
Common Goldeneye		2					2			2							1	1			1		1	1	2	12	25
Bufflehead			2																								2
White-winged Scoter			3																								3
Scoter sp.																	30										30
Merganser sp.		2																							1	6	9
Diver sp.		3	2													8	8	4		5	7	8				32	77
Duck sp.		16	5			13	26		3	13					10	6	69		2	35	2	2	15		12	25	254
Herring Gull						1							1				2	2				34				1	42
Bonaparte's Gull		7															1			2	2						11
Black Tern		8					2										14			2							26
Bald Eagle		1					1																				2
Osprey		1																									1
Marsh Hawk																	1										1
Raven																	1										1
Common Loon		2															1										3
Spotted Sandpiper						2															1	1					4
Sandhill Crane																	2										2
TOTAL WATERFOWL	1	43	21			25	29		3	15			2		10	14	132	5	17	43	18	34	17	5	20	84	538
TOTAL	1	62	21			28	32		3	15			3		10	14	154	7	17	47	21	69	17	5	20	85	631

* See Map 4

TABLE 27

BREEDING PAIRS OF WATERFOWL PER FLIGHT MILE*

RAT-BURNTWOOD DIVERSION, JUNE 14-17, 1973

	SECTION															
	1	2	3	Karsakuwigamak L. - Threepoint Lake	16	17	18	19	20	21	22	23	24	25	26	TOTAL
Canada Goose												.04				.003
Mallard	.14	.15				.04				.10		.04	.05	.56	.22	.045
Blue-winged Teal				NO		.02										.003
Goldeneye	.14	.04												.28	.07	.011
Lesser Scaup					.13	.02			.36		.06	.04				.017
Merganser sp.		.04		PAIRS			.25						.05		.07	.017
Duck sp.		.08	.05		.19	.09		.09		.10			.02	.28	.07	.045
TOTAL PAIRS	.28	.31	.05		.32	.17	.25	.09	.36	.21	.06	.11	.12	1.11	.51	.089

* Unadjusted for visibility

1) Issett Lake
2) Issett L. - Karsakuwigamak L.
3) Karsakuwigamak L.
16) Wuskwatim L. - Threepoint L.
17) Wuskwatim Lake
18) Wuskwatim L. - Opegano L.
19) Opegano Lake
20) Opegano L. - Birch Tree Lake
21) Birch Tree Lake
22) Birch Tree L.-Apussigamasi Lake
23) Apussigamasi Lake
24) Apussigamasi L.- Odei River
25) Odei River (3.6 miles)
26) Odei River - Split Lake

Only three broods were seen during boat surveys in late August, 1973 (Table 28). A total of 679 ducks was observed at 14.1 birds per mile. Most birds were seen in summer staging flocks near sediment shorelines. Mallards and lesser scaup comprised 62.2% of all waterfowl observed.

6.3.5.2 Staging

During staging flights in early September, 2,948 waterfowl were observed (Table 29). Six whistling swans were seen on Threepoint Lake. A total of 361 Canada geese were scattered in small flocks over most of the Diversion Route. Notable concentrations were on the Burntwood River east of Apussigamasi Lake, near the mouth of the Odei River, and on the Rat River between Threepoint and Wuskwatim Lakes. Mallards and green-winged teal comprised 57% of all waterfowl observed on this flight. Concentrations were on the Burntwood River below Apussigamasi Lake, and Wapisu Lake. Scaup and goldeneyes, mainly in small flocks on the larger lakes, comprised only 11% of the waterfowl observed.

By late September, numbers of waterfowl had doubled from earlier in the month. Numbers of whistling swans were up slightly to 16, but numbers of Canada geese declined somewhat (Table 30). Main concentrations of Canada geese were still below Apussigamasi Lake. Dabbling ducks comprised 69% of all waterfowl observed while divers accounted for only 16%. Dabblers were noticeably associated with the exposed mud banks and aquatic vegetation of the upper Rat River, lower Burntwood River and Wuskwatim Lake. Concentrations of scaup and goldeneye on Rat Lake comprised 43% of all divers seen throughout the Diversion Route.

The major importance of the Diversion Route to waterfowl would appear to be as staging habitat. Small flocks of Canada geese use some of the lakes and attractive stretches of the lower Burntwood River in fall. Chester Wishart (pers. comm.) reports seeing 'large numbers' of pintails on Rat Lake in May, 1973. He also saw whistling swans,

TABLE 28

BIRDS OBSERVED

RAT-BURNTWOOD DIVERSION (SURVEY BY BOAT AUGUST 27, 1973)

Species	Shoreline Type					
	LOW BEDROCK	LOW BEDROCK CONTROLLED	MEDIUM STEEP SEDIMENT	SLUMPING OVERBURDEN	LOW SHORELINE MARSH FRINGE	MARSH
Mallard	91	15	302(8Br)*			
Pintail			5			
American Widgeon	5			1(5Br)		
Blue-winged Teal			2			
Green-winged Teal			33			
Dabbler Sp.				2		
Lesser Scaup	1		121(6Br)		40	
Common Goldeneye					10	
Diver Sp.		1				3
Duck Sp.	11	11	2			
Grebe Sp.						2
Semipalmated Sandpiper	1					
Sandpiper Sp.	2					
Yellowlegs Sp.	14					
Great Blue Heron			2		1	
Belted Kingfisher			1			
Bald Eagle			1	1		
Marsh Hawk	2					
Common Nighthawk						
TOTAL WATERFOWL/WATERFOWL PER MI.	108/9.3	27/9.6	477/41.1	8/11.4	50/3.3	3/0.7
TOTAL BIRDS/BIRDS PER MILE	127/10.9	27/9.6	483/11.6	9/12.8	51/3.4	5/1.2
MILES SURVEYED	11.6	2.8	41.6	0.7	15.0	4.2

* Total number of young ducks in broods

TABLE 29
BIRDS OBSERVED
RAT-BURNTWOOD DIVERSION, SEPTEMBER 7, 1973

SPECIES	SECTION*																										TOTALS
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
Whistling Swan															6												6
Canada Goose	27					24	13	5						90	6		12	4		2	11			105	50	12	361
Mallard	8			20		15	40				3	125	189	90	15	27	21	26	3	25			26	152	2	15	802
American Widgeon								4									3										7
Pintail														10		10	18	4						2	6		50
Green-winged Teal				20							3		225	100		20	30	34						40	150	240	262
Lesser Scaup	35	40	30	3										10		5	20	15			3						161
Common Goldeneye	12																145									12	169
Bufflehead																	20										20
Ring-necked Duck																	80										80
Scoter sp.																			2								2
Merganser sp.							12																	12			24
Diver sp.		10		1									12		20												43
Duck sp.	4	22		1			48	2			20			25		35	51	19	28				12	34	10	50	361
Herring Gull																	200	2									202
Bald Eagle							1						1														2
Goshawk								1																			1
Marsh Hawk																	1										1
Hawk sp.															1												1
Osprey																	1										1
Common Loon											1																1
Raven																	5										5
Shorebirds													10	20	30		30							20			110
Great Blue Heron						1								2	1		2				1						7
TOTAL WATERFOWL	86	72	30	45		39	113	11			26	125	426	325	47	97	400	102	33	27	14		38	345	218	329	2,948
TOTAL	86	72	30	45		40	114	12			27	125	437	347	79	97	639	104	33	27	15		38	365	218	329	3,279

* See Map 4

TABLE 30

BIRDS OBSERVED

RAT-BURNTWOOD DIVERSION, SEPTEMBER 26, 1973

SPECIES	SECTION*																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	TOTAL
Whistling Swan																					7			9			16
Canada Goose														20	90			11		6				205			332
Mallard		250		50	43	64	102	37				80	46	87	365	47	405	10		26	9		226	533	397	291	3,068
Black Duck	225			8											12	440	465	7		33							1,190
Pintail																15											15
Green-winged Teal																	4										4
Blue-winged Teal																	70										70
Lesser Scaup		20	40				150													8				25			243
Common Goldeneye	7				100	20	200					5			12		120	3	21	16				62		23	589
Bufflehead																								1			1
Merganser								25			15		22		4		27	72	4	10				2			181
Diver sp.		3			10		36		4		12				15		22			12			8	5			127
Duck sp.		9				6	2	24					27		30		14	5		26			21	80	2	20	266
Herring Gull																	20	2					2				24
Bald Eagle						2		1					1					1						1			6
Marsh Hawk							1										1										2
Common Loon																					1						1
Grebe sp.			15																								15
Raven																	40										40
Shorebirds													30		50		25							100			205
TOTAL WATERFOWL	**232**	**282**	**40**	**58**	**153**	**90**	**490**	**86**	**4**		**27**	**85**	**95**	**107**	**528**	**502**	**1127**	**108**	**25**	**137**	**16**		**255**	**922**	**399**	**334**	**6,122**
TOTAL	232	282	55	58	153	92	491	87	4		27	85	126	107	578	502	1213	111	25	137	17		257	1022	399	334	6,395

*** See Map 4**

Canada and white-fronted (Anser albifrons) geese and canvasbacks.

6.3.5.3 Waterfowl Hunting

Little is known of the use that is made of waterfowl produced in the Rat-Burntwood system as banding data are lacking. Small kills would occur around native settlements and near fishing camps. Most trappers interviewed indicated that they did not hunt waterfowl. Hunting is probably opportunistic and favours geese during spring and fall migrations. Don Spence (pers. comm.) estimates that moose hunters (native) may kill six ducks or geese per day while hunting moose.

Little is known of the harvest of ducks along the Diversion Route around Thompson by sport hunters. Numbers shot are probably low, as considerable travel would be necessary by boat to fall concentrations.

6.3.6 Other Birds

Maximum number of eagles seen along the Diversion Route was six in late September. Ted Muir (pers. comm.) noted two eagle nests along the Rat River, one at Issett Lake and one between Issett Lake and Karsakuwigamak Lake on the Rat River. A Fisheries crew reported seeing one nest on Mynarski Lake.

Other raptors observed in small numbers included ospreys (Pandion haliaetus) and marsh hawks (Circus cyaneus).

Larids included herring and Bonaparte's gulls and common and black terns.

Numerous shorebirds were observed on mudflats along the Burntwood River and Apussigamasi Lake.

6.4 IMPACT OF DEVELOPMENT

6.4.1 Lake Winnipeg

6.4.1.1 Shorelines and Marshes

It is not the purpose of this report to consider physical changes along the shorelines of Lake Winnipeg. Consideration is given, however, to the effect of raised water levels on marshes. Modified historic annual average level for Lake Winnipeg is 713.35 feet asl. Minimum and maximum annual average levels have been 709.67 and 717.16 feet asl respectively. Under regulation, annual mean will be 714.00 feet asl and range will be 711.10 - 716.50 (Water Resources Branch, DMREM 1974).

This system of regulation will result in long-term adjustment of shorelines to the new higher levels, and ostensibly eliminate extreme low and high levels. The factor of wind set-up will not be eliminated, but its potential severity will be lessened as extreme high mean levels will be eliminated under regulation.

During the 1940's when lake levels were approximately 710 - 712 feet asl there were 35,000 acres of productive marsh, haylands and small areas of open water in Netley-Libau marsh - highly productive habitat. There were 50 small lakes in the marsh. As water levels increased throughout the 'sixties, 10,000 acres of this marsh disappeared, and 17 large lakes replaced the 50 smaller ones (Townsend 1969).

Marshes which lose a relatively large proportion of their water reserve during the growing season are more productive of food and cover plants than are those which have high, stable water levels (Cook and Powers 1958). Periods of low water are important annually to support a rich variety of submergent and emergent plants. Periodic very low levels are necessary to release nutrients tied up in the undecomposed organic material. Marshes typically show a great increase in productivity in periods following these low levels (Cook and Powers 1958). Periodic fluctuations in water levels are necessary to allow establishment of wide bands of productive emergent and submergent plants, offering maximum amounts of edge for use by wildlife.

Prolonged productivity in the reed swamps of Lake Winnipeg, such as Netley-Libau marsh, is dependent on good aerobic conditions in the soil. Stable, high water levels result in an anaerobic state which stops vegetative reproduction in the reed swamp emergents and leads to eventual die-offs (Photo 19). These die-offs can be related to nutrient difficiencies. Length of time for stagnation to effect a change in plants varies with species, but cattail is usually the first to degenerate (Macleod et al. 1951).

6.4.1.2 Furbearers

Diversity, abundance and availability of preferred food species are expected to improve at first and then decline as levels are stabilized in the higher ranges.

The muskrat population of Netley-Libau should respond favourably for 3-4 years as levels rise under regulation. Preferred food and cover plants could flourish with raised water levels with a concomitant increase in numbers of muskrats. After this period, however, populations are expected to decline as stagnation eliminates variety in emergent vegetation, unless some form of level manipulation is effected.

6.4.1.3 Waterfowl

Townsend (1969) states that peak waterfowl use and production on Netley-Libau marsh has been directly correlated with periods of low

PHOTO 19

Netley-Libau marsh, Lake Winnipeg. Emergent vegetation zones recede with high, stable water levels. Periodic low water levels are necessary to maintain aerobic soil conditions and prevent stagnation. Furbearer and waterfowl productivity is directly related to abundance and state of the emergent plants in a marsh.

PHOTO 20

Cofferdam at Missi Rapid, where Southern Indian Lake enters lower Churchill River.

PHOTO 21

Stable shoreline, Fidler Lake. Woody vegetation will invade such exposed shorelines with lowered water levels along lower Churchill River.

PHOTO 22

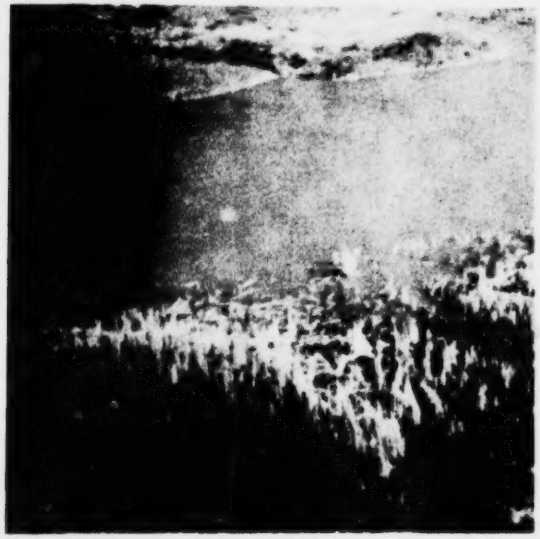
Drowned timber, Kelsey Reservoir. Several hundred miles of this type of shoreline will occur along the Diversion Route following flooding.

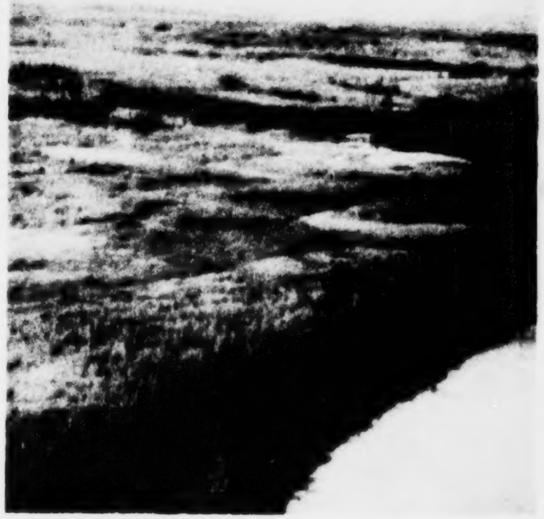
PHOTO 23

Slumping, Opegano Lake. Erosion and slumping will be common along shorelines with heavy overburden following flooding along the Burntwood River.

PHOTO 24

Shallow bay offering food to waterfowl and shorebirds, Burntwood River. These bays will disappear after diversion.





water. It is during these periods that heaviest use was made of the marshes by dabbling species.

With the increased stability of water levels proposed, and elimination of the periodic low cycles, productivity of the marshes on Lake Winnipeg in terms of ducks, will be less in some years than under natural conditions. Climax vegetation which becomes established under stable conditions does not offer the variety of nesting habitat, food and cover necessary to most resident species of waterfowl. Production at all trophic levels is reduced. Plants which thrive under those conditions are not preferred waterfowl foods. Autumn use of the marsh could also decline on the average.

Under regulated conditions water levels will remain high throughout August and September.
Under natural conditions, reductions of levels towards the end of the summer make available a great deal of seeds and invertebrates that are sought by staging ducks.

6.4.1.4 Colonial Nesting Birds

Some evidence of decline in populations of colonial nesting birds may be seen with decreasing productivity of major marshes, but this is not expected to be a significant factor.

The major colonies of white pelicans and double-crested cormorants are located on islands of sufficient elevation that little effect will be felt from higher mean levels. However, with higher levels, and wind set-up unchanged from historic, numbers of lower, peripheral islands available to pelicans for periodic sub-colonization would be reduced in some years (Photo 14). The significance of this to pelican population survival is unknown.

Caspian terns typically nest on sandy beaches close to water level. This species, common terns and gulls which use low small reefs and rocks may find in some years that fewer potential nesting sites are available to them with raised water levels.

Species such as western grebes, and Franklin's gulls which nest on floating vegetation will not be directly affected by the raised levels. However, disappearance of some emergent vegetation with higher water levels may force changes in breeding locations and result in lower, overall production.

6.4.2 Lower Churchill River

Mean annual average flows at Missi Rapid will be reduced from 35,692 cfs to 8,857 cfs (DMREM 1974). Minimum flow from May - October can be as little as 500 cfs. Flows will peak in June at 65% of historic conditions, but will drop in September to 19% of natural.

Reductions in surface areas of lakes downstream of Missi Rapid will be dramatic (Table 31).

6.4.2.1 Shorelines and Marshes

Newbury (1970) has predicted that the ice regime of the entire river will be significantly changed, eliminating ice scouring along the banks. Recent studies by LaSalle Laboratories (Betty Nowicki pers. comm.) have suggested that ice scouring will continue after regulation. Because of the greatly reduced amount of water available for ice formation in the rivers and lakes and the reduced flows in May, June and July, it is doubtful that future ice scouring could be of the same magnitude as in the past. Peak flows during June will only be 65% of historic. Where ice-scouring ceases after regulation, woody, perennial vegetation will colonize the clays and tills of the shorelines with resultant loss of sedges now grazed by Canada geese (Photo 21).

TABLE 31
CHANGES IN LAKES ALONG LOWER CHURCHILL RIVER FOLLOWING CLOSURE AT MISSI RAPID*

	MEAN HISTORIC	REGULATED MEAN	REGULATED MINIMUM	DEAD STORAGE
PARTRIDGE BREAST LAKE				
Elevation	803.50	793.66	788.36	785.66
Flow	35,894	9,043	540	0
Changes from Mean Historic Conditions				
Level Reduction		9.84	15.15	17.84
Flow Reduction		74%	98%	100%
Volume REduction		34%	61%	66%
Surface Area Reduction		31%	41%	43%
NORTHERN INDIAN LAKE				
Elevation	774.04	763.73	758.76	755.66
Changes from Mean Historic Conditions				
Level Reduction		10.31	15.28	18.38
Volume Reduction		35%	48%	54%
Surface Area Reduction		15%	36%	44%
FIDLER LAKE				
Elevation	759.63	751.24	747.20	745.00
Changes from Mean Historic Conditions				
Level Reduction		8.39	12.43	14.63
Volume Reduction		66%	82%	87%
Surface Area Reduction		38%	67%	79%
BILLARD LAKE				
Flows	37,415	10,631	1,550	0
Changes from Mean Historic Conditions				
Flow Reduction		72%	96%	100%

*Data from Water Resources, Dept. Mines Res. Environ. Manage, 1971 and 1974.

Break-up in spring may not be significantly delayed. Normally, high flows in July break up the softened ice. Reduction of average flows in the fall to approximately 20% of normal will delay the date of freeze-up near the mouth by 15-30 days (Betty Nowicki pers. comm.). Early ice from the river may be of reduced significance in the creation of shore-fast ice at Cape Churchill.

Predominance of sea water in the estuary throughout most of the year will bring about changes in the estuarine flora and fauna.

The flow regime under regulation will result in an unstable vegetative community throughout most of the lower Churchill. Under normal conditions average lake levels downstream from Missi vary only 3.5 - 4.5 feet from April until October. With regulation at Missi, however, variations in average lake levels may be greater than 10 feet during this same period. Large expanses of mud banks will be prevalent throughout the area in early fall as flow is diminished to build up storage in Southern Indian Lake.

6.4.2.2 Moose

Moose in the lower Churchill River area will be indirectly affected through the physical and vegetational changes of shorelines. Reduced flows and levels will decrease the surface area of lakes. Willow shrub communities developing along exposed shorelines would provide additional moose browse. Current marsh areas will largely dry up, reducing the amount of aquatic vegetation available, which even under natural flow conditions is not high.

Ice formation on the lakes of the system will be altered and may have a potential effect on mobility of moose in winter but this should not be of major consequence.

With reduced lake levels some of the islands in Northern Indian Lake may become accessible from shore, allowing increased predation during calving season. The overall potential of the Study Area to produce moose should not be seriously affected.

Moose hunting in the area should not be significantly affected as harvests are presently low and access is difficult.

6.4.2.3 Barren-ground Caribou

Barren-ground caribou are probably not dependent on lake or river shorelines for food. Their range would therefore be little affected by the physical changes along the Churchill River. Use of the Study Area is at present limited to migration in the late fall.

As the zone of migration extends considerably north of the Churchill River the impact on caribou after diversion is not expected to be significant. Large expanses of suitable winter range consisting of open black spruce forest and muskeg are available outside the Study Area.

As access into the Study Area will not be greatly enhanced, the potential for harassment of barren-ground caribou is not significant. Forest fires destroy winter range and a higher forest fire incidence could be harmful.

Secure ice conditions are necessary for the mobility of ungulates. The significant changes in flows and levels which will occur along the Churchill River may have an effect on future caribou winter migration patterns but only if more southerly movement patterns are re-established. Reduced flows may cause earlier ice formation. Lower levels may also result in lakes freezing over at an earlier date. Available information suggests that flows may fluctuate in the early winter, thereby affecting the ice cover, which could make caribou movements difficult should they attempt to cross.

There will be no effect on the utilization of caribou by natives.

6.4.2.4 Polar Bears

Reduced fall flows in the Churchill River may have an effect on polar bears on Cape Churchill. Delay of land-fast accretion ice along the coast could result in bears remaining on land longer than under natural circumstances. The problems currently found each year in the town would then continue for a longer period.

Polar bears may also be indirectly affected through changes in the estuary and the associated vegetation and food resources available to bears.

6.4.2.5 Furbearers

Changes in vegetation along shorelines will result from reduced flows and levels along the lower Churchill River and lakes. Vegetation changes will directly affect furbearer habitat and consequently production potential. An estimate of production potential losses is difficult for this area.

The effect on trapping methods and motivation may be more significant than the changes in habitat. Transportation will be more difficult with the change in ice regime.

A reduction in marsh areas will reduce the potential of the area for muskrat production, but as this is presently low, the effect on trapper income should not be serious. Average annual values of affected RTL's are given in Table 32. The area of Northern Indian Lake (S.I.L. RTL's 12 and 13) and the Churchill River from Fidler to downstream of Billard Lake (Split Lake RTL's 38, 39 and 46) show the highest returns. As there is no information available showing where furbearers are trapped in any of these RTL's, an accurate assessment of potential effects cannot be made.

TABLE 32
AVERAGE ANNUAL RETURNS FROM RTL'S AFFECTED ALONG THE LOWER CHURCHILL RIVER *

Churchill Section

RTL	Average Value
2	$ 290 (3)**
11	299
12	298 (2)
14	116 (1)
15	-
16	48 (1)
17	-
Community Line	317 (3)

Split Lake Section

RTL	Average Value
38	$ 1,376
39	1,763
46	1,005
50	-
51	-
52	252 (4)
53	719 (4)
55	-

Soutnern Indian Lake Section

RTL	Average Value
10	$ 205 (3)
11	587 (3)
12	1,953 (4)
13	1,277
14	478 (3)

---

* 5 year average 1967-68 to 1971-72

**average for ( ) no. of years if data not available for all 5 years.

Source: DMREM Fur Dealer Returns, The Pas, Manitoba

Traplines in the Churchill Section show very low returns (Table 32). Much of the production in this area may come from small creeks and ponds off the main system. Trapper motivation may be low in the town of Churchill as other work alternatives are more attractive than trapping.

6.4.2.6 Waterfowl

Current value of the river to geese through its miles of ice-scoured banks will drop significantly. Surveys have shown that the river is an important summer moulting and early fall staging habitat. Production of Canada geese along the shores of the large lakes and the river itself is low, but production in the nearby muskeg ponds is at least moderate.

Although overall production of waterfowl along the river is not high, certain areas of marsh habitat are used as breeding locations by many dabbling ducks. With regulation, many of these areas will be overgrown with perennial shrubs.

Value to post-breeding or non-breeding flocks of diving ducks will be diminished as food will be reduced in quantities or rendered unavailable when average flows are increased from 2,025 cfs in April to 25,409 cfs in mid-June.

Under the currently proposed water release scheme, nesting by waterfowl downstream of Missi Rapid, and throughout most of the river valley, will become tenuous. During the peak nesting period (May - June), natural water levels vary less than two feet, but under regulation, water will rise rapidly in June to 6-7 feet above May levels.

As water levels recede in August and September exposed banks may provide resting and feeding habitat to ducks, geese and shorebirds.

6.4.2.7 Raptors

If quantity or availability of forage fishes is diminished during critical periods, attractiveness of the lower Churchill to bald eagles could be reduced. Nest sites should not be affected by the new regime.

6.4.2.8 Other Birds

Small colonies of terns have been established in lakes of the lower Churchill River system. With the large fluctuation in regulated levels it will be impossible for these birds to nest successfully.

6.4.3 Rat-Burntwood Diversion

With diversion of 30,000 cfs of the Churchill River's flow through the Rat and Burntwood Rivers, significant changes will take place in the size of lakes and within the river channels themselves. Virtually all of the current marshes and riparian wildlife habitat will be lost through flooding.

6.4.3.1 Shorelines and Marshes

When the proposed level of 850 feet asl is reached behind the Notigi structure, present water surface area to South Bay will be increased threefold. Shorelines of lakes and rivers in the new reservoir will be more than doubled (Table 33). Those lakes with steep bedrock shorelines will be affected least by flooding.

With increased flows (and without other dams on the Burntwood) lakes downstream of Notigi will increase in surface area and shoreline distance by 100% and 54% respectively. With regulation at Taskinigup and Manasan Falls, surface areas of Wuskwatim and Birch Tree Lakes will increase by approximately two and 27 times current mean surface areas. Shorelines of these lakes will increase by four and 36 times

TABLE 33
CHANGE IN SURFACE AREA AND SHORELINE DISTANCE
LAKES, RAT-BURNTWOOD DIVERSION

LAKE	NORMAL SURFACE AREA sq. mi.	REGULATED SURFACE AREA sq. mi.	INCREASE %	NORMAL SHORELINE DISTANCE mi.	REGULATED SHORELINE DISTANCE mi.	INCREASE %
Issett	0.8	*		6.9		
Karsakuwigamak	6.6	14.1	114	20.8	44.7	114.9
Pemichigamau	8.0	13.9	74	30.2	52.2	72.8
Rat	28.6	62.5	119	147.2	163.3	10.9
Mynarski	7.2	12.5	74	46.4	49.0	5.6
Misinagu	1.3	2.4	85	10.1	11.1	9.9
Notigi	7.9	34.4	335.4	37.0	164.3	344.0
Wapisu	15.6	26.9	72.4	82.1	154.4	88.1
Threepoint	16.0	25.6	60.0	62.6	86.2	38.0
Footprint	7.4	14.6	97.3	42.0	47.4	12.9
Wuskwatim	25.0	39.7/73.6**	58.8/194.4	49.1	85.4/255.2	73.9/419.8
Opegano	2.3	2.8	21.7	5.7	6.6	15.8
Birch Tree	2.0	8.4/56.4+	320.0/2720.0	6.5	77.2/241.4	1087.6/3613.8
Apussigamasi	4.5	N.A.	-	29.3	N.A.	

*- Total surface area of reservoir from South Bay - Karsakuwigamak will be 96.6 square miles (Shoreline Impact Study).

** Development at Taskinigup Falls

+ Development at Manasan Falls

respectively. Figures for Wuskwatim Lake were taken from maps with only the 800 foot contour interval shown. Flooding will be much more severe when water reaches the 810 foot level.

The Physical Impact Study has estimated that approximately 32 square miles of sedge communities will be flooded in the Notigi Reservoir. Over half of this area will be from South Bay to Karsakuwigamak Lake. Estimates of total land flooded in the reservoir vary; Impact - 210.5 square miles, Forestry - 161.8 square miles.

Willow-alder and marsh-muskeg types identified in Forestry Inventory are valuable habitat to wildlife. Totals of these types (square miles) lost in flooding in Notigi, Wuskwatim and Birch Tree Lake reservoirs are as follows:

Reservoir	Willow-Alder (sq. mi.)	Marsh-Muskeg (sq. mi.)	TOTAL (sq. mi.)
Notigi	7.4	12.5	19.9
Wuskwatim	10.7	7.8	18.5
Birch Tree Lake	2.1	4.1	6.2
TOTAL	20.2	24.4	44.6

No data were available at time of writing on flooding downstream of Manasan Falls.

The Physical Impact Study discusses the processes and time span required for the evolution of new shoreline types. It is not the purpose of this report to repeat that description in its entirety. However, knowledge of the time taken for flooded shorelines to become attractive to ungulates, furbearers, waterfowl and other wildlife is important. The following descriptions are interpretations of processes predicted by the Physical Impact Study.

Generally, evolution of bedrock-controlled shorelines to original state is much faster than that for low shorelines, i.e., types 24 and 28. Evolution of the latter to productive, willowed shoreline with extensive marsh may take tens or hundreds of years, or may not occur at all.

Re-establishment of low shorelines is greatly dependent on the degree of flooding, strength of erosional processes and vegetative cover prior to flooding. Under restricted flooding (up to 2 feet), shrub colonization is well underway within 20 years and grasses and sedges may become established in the dead shrub and tree zone within 5 years. Dead timber will remain standing after 20 years. In some instances, marsh vegetation may adjust to the new level.

With low level flooding (2-10 feet), there will be larger areas of dead timber, still upright after 20 years. Colonization by shrubs and grasses usually occurs within 5 years and shrubs will establish within 20 years.

Where water is raised more than 10 feet (high level flooding) new shoreline is often of different slope and material, and therefore a completely new type will evolve.

Within 50 years after flooding, development of marsh on low shorelines will depend on slope, water level fluctuations and wave action.

The evolution of flooded low shorelines to productive wildlife habitat is greatly dependent on the presence or absence of dead, standing timber. At Kettle Reservoir, a 10 foot wide zone of willows and a 20 foot wide zone of emergent vegetation had developed within four years on a shoreline cleared or initially free of trees. Other sites with identical substrate but with dead, standing timber had no willows or sedges present. Rapid appearance of sedges has also been noted on flooded muskeg where clearing and/or burning took place prior to flooding (Impact Study).

6.4.3.2 Moose

The immediate effect of the development will be to flood existing browse and aquatic vegetation along shorelines, thereby eliminating some summer feeding areas for moose. All willow fringe will be lost on low shorelines. Summer carrying capacity of the area will be reduced until willows and other browse become re-established. Consequently, the opportunity for the native moose harvest along shorelines will be reduced. Moose will still be available, however, in upland areas.

Assuming a potential density between 0.25 and 0.5 moose per square mile for the area flooded by a structure at Notigi (158 square miles), there will be a loss of habitat for approximately 40 - 80 moose. The loss of habitat could result in a loss of a potential harvest of 10 - 20 animals annually (20% of base population).

The development of the Wuskwatim and Manasan sites would mean a further loss of potential moose habitat for 20 - 40 and 15 - 25 animals, respectively. Total losses may be as high as 75 - 150 moose for all structures. This would mean a potential harvest loss of 15 - 30 moose (Table 34).

No major "crossings" have been noted. The rivers under the new regime should not seriously impede travel by moose.

TABLE 34

RAT-BURNTWOOD DIVERSION
MOOSE HABITAT LOSS AND POTENTIAL
NUMBER OF MOOSE AFFECTED

Reservoir Area	Total Area Affected (Square Miles)*	Estimated Number of Moose Affected **
Notigi	158	39 - 79
Wuskwatim	84	21 - 42
Manasan	53	13 - 26
Total:	295	73 -147

* Areas from Forest Inventory Data, DMREM.

** Calculated from an estimated average density of 0.25 - 0.50 moose per square mile.

As the majority of the moose harvest by Treaty Indians is along shorelines, a major portion of the moose harvest value may be lost after flooding behind Wuskwatim unless adjustment is made in hunting patterns. Some hunting areas will, however, remain unflooded, such as the area northeast of Nelson House.

Moose harvests along the Burntwood River and in particular at Wuskwatim Lake would be seriously affected by a structure at Wuskwatim. As few moose are presently harvested in the area to be directly affected by Notigi, flooding there would not have a serious effect on present native hunting patterns.

Increased access into the Study Area is leading to an increase in recreational hunting. Much of the area is now accessible via the new highway from Thompson to Leaf Rapids. This will lead to increased moose hunting in the Rat Lake area and the upper part of the Diversion in particular. Sport hunting patterns will probably change. The flooding of Notigi and other reservoirs may provide access by power boat to remote hunting areas.

Increased recreational hunting may conflict with subsistence hunting by natives. As the area has a low production potential, management regulations may be necessary to allow natives to harvest sufficient moose for food and hides.

Some harassment of ungulates will occur with increased access to the area, but should not be of major concern.

6.4.3.3 Caribou

Flooding from Notigi and additional control structures will result in some loss of potential winter habitat for both barren-ground and woodland caribou. Neither is dependent on shorelines but as flatland areas are flooded, such as marshes and the edges of creeks and ponds, there will be some potential loss. Such areas can provide food in the form of forbs and lichens. Large expanses of preferred winter range, open black spruce forest, will remain.

However, as barren-ground caribou have not recently used this part of their winter range there will be no immediate effects. Consequences will depend upon future range extensions. At present, woodland caribou are not dependent on the area for winter range, but may be in future.

Secure ice conditions are necessary for the mobility of ungulates. Significant changes in water levels during winter may have an effect on caribou using the ice surface of lakes, but the consequences of this, if any, are difficult to predict.

6.4.3.4 Furbearers

Furbearers will be directly affected by inundation of habitat. All marshes will be lost within the floodline. Furbearing animals will be displaced by rising water and will be lost to the area. They cannot be expected to find suitable habitat not already occupied by individuals of the same species.

Beaver

Some loss of habitat for beaver will result from partial inundation of creeks flowing into the system. Inundation of food plants will occur with a rise in water level. Young deciduous growth along creeks will be lost.

Total area of land inundated as a result of the Notigi structure will be approximately 158 square miles. If densities are 2.8-7.7 beaver per square mile in "Precambrian" bog drainage, as quoted in

Novakowski 1965, losses of potential habitat may represent a base population of 450-1,200 beaver. Additional structures at Wuskwatim and Manasan would result in potential losses of 250-650 and 150-400 beaver, respectively (Table 35). If potential harvest is considered as 0.5 per square mile, then potential loss of harvest resulting from the Notigi structure would be approximately 80 beaver annually and from additional structures at Wuskwatim and Manasan, 40 and 25 beaver, respectively.

Lynx

Lynx will be affected indirectly through the effect of flooding on their prey. Loss of shorelines will reduce the availability of hares. Partial loss of home range will result in displacement of some lynx. RTL's affected along the Diversion route produce an average of 64% of the lynx pelts in the Nelson House section (Table 35). The effect on production potential of this species can only be approximately estimated. Flooding from the Notigi structure may result in the loss of potential habitat for 30 lynx, with densities of 0.2 per square mile (Nellis et al. 1972). Total losses with all structures may be 60 lynx (Table 35). Fur harvest losses cannot be estimated as there is no figure available for the normal harvest of lynx per square mile. A decline is certain to occur but may be masked by the natural decline of lynx populations in the area. The area of the Notigi reservoir (RTL's 28, 29, 30, 33 and 34/35) is particularly productive of lynx as reflected by recent fur returns (Appendix 13). Development at Wuskwatim may also result in declining lynx returns as RTL's 39 and 49 (Community Line) are very productive of lynx (Appendix 13). Significant areas of large burns will not be affected by flooding and prey availability should not be seriously affected in those areas.

TABLE 35

RAT-BURNTWOOD DIVERSION
FURBEARER HABITAT LOSS AND POTENTIAL NUMBER OF BEAVER AND LYNX AFFECTED

Reservoir Area	Total Area Affected (Square Miles)*	Estimated Number of Beaver Affected**	Estimated Number of Lynx Affected***
Notigi	158	450 - 1200	31
Wuskwatim+	84	250 - 650	17
Manasan	53	150 - 400	10
Total:	295	850 - 2250	58

* Areas from Forest Inventory Data, DMREM

** Calculated from an estimated density of 0.5 - 1.1 beaver lodges per square mile for "Precambrian bog drainage" (2.8 - 7.7 beaver per square mile), quoted by Novakowski (1965). Totals are approximate only.

*** Calculated from an estimated maximum density of 0.2 lynx per square mile (Nellis et al. 1972), (Winter density of 11 lynx in 57 square miles). Totals are approximate only.

+ 800' level.

Mink

Mink will be seriously affected as this species is dependent on shorelines for cover and food supply. Loss of productive shorelines such as marshes, creek mouths and low shorelines will reduce food supply. Mink will be displaced from inundated areas. Approximately 71% of the mink harvest in the Nelson House section is produced in RTL's affected along the Diversion.

The potential of the area to produce mink will be adversely affected through loss of habitat. Flooding from Notigi will eliminate potenially productive shorelines such as along the upper Rat River, between Karsakuwigamak and Issett Lakes (Photo 7). The most productive Nelson House RTL's in terms of mink production have been RTL's 12, 33, 49 and 60. Mink production appears to be well distributed throughout the Study Area. Returns of mink pelts have greatly declined in the past few seasons (1969-70 to 1971-72) as reflected by fur returns (Appendix 14). Populations may be declining.

Muskrats

Muskrats will be directly affected by loss of marsh habitat, particularly along shoreline types 28, 23 and 25. The area of the upper Rat River will be extensively flooded and will represent substantial loss of potential muskrat habitat. Marsh changes will result in a corresponding loss of production potential and perhaps some income reduction to trappers. The watershed west of Issett Lake is also good muskrat habitat which will be flooded. This area was reported by Bryant (1954) as providing a "fair portion" of the muskrat harvest of Southern Indian Lake RTL 4.

Potential numbers of muskrats were estimated from "marshy" shoreline types (Type 28) by applying a figure of 55 muskrats per mile (bank run) of emergent shoreline (Ambrose and Allison 1973). Using that figure, flooding behind the Notigi structure may affect as many as 4,400 muskrats. With additional structures the total number of muskrats affected may be as high as 5,830 (Table 36). As annual harvest rates of 80% do not appear to harm muskrat populations (Schmitke 1971) a loss of a potential harvest of 3,500 for the Notigi reservoir and a total of 4,600 muskrats for all reservoirs may occur. However, the figure is misleading. Under actual trapping conditions this potential would not be realized. Only a small fraction has been realized in the past few years.

The most productive muskrat traplines are Nelson House RTL's 12, 27, 33, 40 and 49. Numbers 12 and 49, the most consistently productive, would both be affected by Wuskwatim development. Approximately 69% of the annual average muskrat production in the Nelson House section comes from RTL's affected along the Diversion.

Flooding of productive furbearer habitat will occur with the Notigi structure. There will also be a downstream effect from Notigi even if no other sites are developed. Increased water flows with diversion will have an eroding effect on soft shorelines. Fluctuating flows in summer may leave some beaver and muskrat colonies high and dry. Suddenly increased flows may cause destruction of lodges and may result in direct mortality. Mink and lynx will be indirectly affected through the effect on prey species.

Traplines along the Diversion will be affected to varying degrees by flooding, area lost ranging from 1% to 50% (Table 37). As the area affected will be mostly productive shoreline, there will be a corresponding loss of potential fur production. The actual effect may be greater or less than the percent of land area lost (Table 37). Shoreline and marsh areas contribute significantly

TABLE 36

RAT-BURNTWOOD DIVERSION
LOSS OF PRODUCTIVE SHORELINE TO MUSKRATS* AND POTENTIAL NUMBER OF MUSKRATS AFFECTED

Reservoir Area	Approximate Miles of Shoreline Type 28	Estimated Number of Muskrats Affected +
Notigi**	80	4,400
Wuskwatim ***	24	1,320
Manasan ***	2	110
Totals:	106	5,830

* Productive muskrat shoreline - assuming that shoreline type 28 (Newbury 1973) represents the best potential muskrat habitat.

** Miles of shoreline from Physical Impact Study (1974).

*** Miles of shoreline from Newbury (1973), adjusted by 50% to make up for ponds and streams not classified by Newbury (1973).

+ Calculated from an estimated 55 muskrats (bank run) per mile of emergent shoreline (Ambrose & Allison 1973).

TABLE 37

RAT-BURNTWOOD DIVERSION
AVERAGE ANNUAL FUR HARVEST VALUES* AND PERCENT OF LAND AREA AFFECTED IN REGISTERED TRAPLINES

Nelson House Section

RTL No.	Average Annual Returns for 1967/68-1971/72***	Percent of RTL Flooded****	Percent of RTL Area Actively Trapped to be Flooded+
2/3	433 (4)	7**	
4	1,397	11**	40
5	711 (4)	50**	50
8	720 (2)	++	
9	829	1**	
12	3,760	1	
18	1,154 (4)	1	
26	1,698 (4)	15	70
27	1,045 (4)	22	50
28	1,970	7	40
29	711	14	
30	2,422	3	-
31	1,004	5	
32	1,505 (3)	++++	
33	3,930	1	
34/35	1,946	15	30
36	1,906	30	
37	1,283	35	10
38	1,224	15	
39	5,502	4**	10
40	1,828	3**	5
41	479 (4)	1**	
42	682 (4)	2**	5
47	1,325	20**	1
49+++	3,645	9**	25
53A	137 (3)	20**	
53B	13 (1)	++	
60	2,680 (4)	13**	

TABLE 37 (continued)

RTL No.	Average Annual Returns for 1967/18-1971/72***	Percent of RTL Flooded****	Percent of RTL Area Actively Trapped to be Flooded+
Southern Indian Lake Section			
3	1,390 (4)	15	
4	3,527	27	
Split Lake Section++			
11	1,750		
12	1,779		
70	1,738 (4)		
Thicket Portage Section++			
32	795 (3)		
Pikwitonei Section++			
44	1,151		
57	5,153		
60	1,028		
67	837 (2)		

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* Calculated for the 5-year period 1967/68 to 1971/72 except where values were calculated from number of years shown in brackets.

** Indicates flooding from proposed Wuskwatim and Manasan structures.

*** Based on fur dealer returns and average Winnipeg prices (see Appendices 11, 13, 14)

**** Approximate land area which will be flooded in each RTL (based on area calculations) from Notigi, Wuskwatim and Manasan structures.

+ Areas actively trapped from Trapper Interviews. Percent to be flooded is approximate only, from Notigi (850'), Wuskwatim (800') and Manasan (690') floodlines.

++ No area calculations done, floodline information for First Rapids not available.

+++ Community Line.

++++ Under maximum Notigi flooding only.

more to furbearer production and are trapped more intensively than upland areas (Appendix 7). On the other hand some affected shorelines may not have been trapped or trappable for reasons of remoteness, etc. Inland creeks and ponds connecting with the system will also be affected. Goulden et al. (1968) suggest that the most productive sites are low lying areas adjacent to water courses, which are the first to be flooded. Suitable habitat will be reduced in all traplines. Many will however, still retain areas of good potential furbearer habitat.

Forty RTL's will be directly affected by flooding. Thirty of these are in the Nelson House Section. Average annual returns and percent of land area which may be flooded are given in Table 37. One method of assessing the degree of potential impact to RTL's is to consider the percent land area flooded within each one. It must be emphasized that figures in Table 37 are minimum estimates only, as the 800' floodline for the Notigi reservoir was used in calculations. Those RTL's losing greatest amounts of trapping potential will be Nelson House RTL's 5, 27, 36, 37 and 47; and Southern Indian Lake RTl 4. Some RTL's (e.g., number 53A - 20% of land area) will suffer loss of potential habitat but as there has been little production over the past five years ($137 average annually) there will be little effect on income to trappers.

As no floodline information was available for the First Rapids site, a similar treatment of RTL's affected in the Split Lake, Thicket Portage and Pikwitonei Sections cannot be accomplished. Shoreline habitat along the Burntwood River would be lost. Effect on furbearers will be similar to that predicted for the upstream sites.

6.4.3.5 Waterfowl

All of the currently attractive nesting areas and many of the staging sites will be lost with flooding. Numbers of pairs of breeding waterfowl observed during flights in June would not indicate heavy use of breeding habitat along the Rat and Burntwood Rivers. The area is more important for staging.

With inundation, many dead trees will be produced, providing nesting habitat for tree nesting species, e.g., goldeneye and wood ducks. Flooded timber can be highly productive of waterfowl, if large expanses of shallow water over rich soil occur. Lack of nesting and loafing sites are usually the limiting factors in these areas (Thompson et al. 1967).

Features which make certain areas along the Rat and Burntwood Rivers attractive to staging waterfowl will be lost after flooding; these include the large expanses of sedge and exposed mud flats (Photo 24). Food on the latter areas, both plant and animal, is the critical factor in attracting ducks and geese.

Large expanses of potentially productive low land are being flooded throughout the Diversion Route. The time required for aquatic vegetation to establish on these areas will determine future attractiveness to waterfowl. Clearing along shorelines in these areas would greatly speed re-establishment of attractive habitat.

Waterfowl using the large, open lake areas for short migration stops will not be signficantly affected by flooding.

6.4.3.6 Other Birds

Shorebirds will not find natural exposed mudflats (Photo 24) in late summer and early fall. Flows and levels will remain high throughout summer and fall under regulation.

Passerine species dependent on riparian, deciduous growth will be diminished until attractive shoreline habitat evolves.

6.5 POSSIBLE MITIGATION PRACTICES

Several practices could be implemented which would lessen the effect of the hydro development on wildlife resources and utilization of these resources. It is understood that other evaluations may be required before implementation of any mitigation practice.

6.5.1 Lake Winnipeg

This section discusses the major types of mitigation that should be considered to decrease the impact on Lake Winnipeg of relatively stable water levels in higher ranges.

6.5.1.1 Establishment of a Co-ordination Committee

A committee should be created to co-ordinate management and establish priorities for wildlife habitat improvement on Lake Winnipeg. Consideration should be given to management of the major marshes, particularly Netley-Libau, for optimum production and harvest of waterfowl and muskrats. Consideration should also be given to monitoring of the status of colonial nesting birds such as white pelicans and double-crested cormorants. This committee could consist of experts from Ducks Unlimited, the Canadian Wildlife Service and the Manitoba provincial government.

6.5.1.2 Consideration of Marsh Management Techniques for Netley-Libau Marsh

Diking and Pumping

Manipulation of water levels in the marshes could result in the following:

1. elimination of nest loss through flooding.

2. elimination of nest loss through wind set up.
3. creation of more nesting and loafing sites through lowered water levels.
4. increase of overall productivity through drawdown and flooding techniques.
5. increase of attractiveness to staging waterfowl.
6. increased production of muskrats.

Diking could be carried out on an experimental basis on some of the smaller lakes of Netley-Libau. Changes in waterfowl and muskrat production could serve as a basis for future large scale diking programs.

A Ducks Unlimited report (Winslow 1969) suggested a diking system to isolate Netley-Libau from water level fluctuations of Lake Winnipeg. Six areas were selected for diking with total estimated length of dikes at 46.5 miles. These dikes would give external protection from wind set-up and a three foot wave, and allow flushing with Red River water.

Manipulation for optimum harvests of muskrats could be co-ordinated with management for waterfowl purposes.

Creation of Islands

Consideration should be given to establishment of new nesting sites by creation of small islands.

Pothole Blasting and Ditching

To create new nesting habitat consideration should be given to blasting potholes and ditching. Potholes and ditches should be created where water levels will be sufficiently high and stable to provide good nesting and brooding habitat. Value of these techniques in increasing productivity of waterfowl is well established.

Planting of Attractive Food Species

If and where possible, consideration should be given to planting of valuable waterfowl food plants. Careful examination of waterfowl requirements should be carried out. If water level is manipulated through diking, species composition of vegetation can be controlled without much planting effort.

6.5.1.3 Canada Goose Habitat

Consideration should be given to management of specific areas for giant Canada geese. Breeding populations are increasing and their use of marshes on Lake Winnipeg could be encouraged. Consideration should be given to stocking and creation of nesting platforms to speed establishment of new groups.

6.5.1.4 Determination of Optimal Water Regimes

Water levels in managed marshes should be manipulated to minimize shoreline erosion and maximize habitat variety. Lowered levels (1-3 feet) are important in late summer for best growth of submergent and emergent plants. Levels should not be raised more than 6-12 inches after freeze-up to prevent destruction of emergent stands of vegetation and displacement of furbearers.

6.5.2 Lower Churchill River

This section discusses the types of mitigation practices that should be considered to decrease the impact of lowered and unnatural flows in the lower Churchill River.

6.5.2.1 Monitoring of Wildlife Resources

A system should be established for the monitoring of the effect of regulation on the wildlife along the lower Churchill River, at and around the estuary. This system should be created by those Federal, Provincial and private organizations with specific concerns in this area, e.g., migratory birds, furbearers, beluga whales and polar bears, and big game. On-going research could suggest directions for wildlife and fisheries management and for regulation of water regimes by Manitoba Hydro.

6.5.2.2 Modification of Proposed Flows

Under current proposed flow patterns, destruction of waterfowl nests will occur downstream of Missi Rapid with release in June. Rapid increases in water level of 6-10 feet will come in mid-June; natural increases are less than 2-3 feet in mid-July. Under normal conditions most waterfowl nests have hatched by the time the spring flows reach the lower Churchill.

Consideration should be given to gradually releasing more water earlier in spring in order to maintain levels similar to natural along the river throughout the laying and incubating season.

If elimination of natural ice-scouring does occur it will reduce the food available to Canada geese. Consideration should be given to maintenance of flows sufficient to provide the ice-scouring effect.

With reduction in fall flows, there might be significant delay in creation of shore ice along Cape Churchill. Polar bears appear dependent on this ice to leave the mainland each fall. The situation should be closely monitored and higher fall flows re-established if feasible to do so.

6.5.2.3 Regulation of Lakes Downstream of Missi Rapid

If the only way to achieve increased flows and levels downstream of Missi is by the construction of weirs, then consideration should be given to this possibility.

Areas of mud flats will be exposed in fall and perennial shrubs will grow to the summer high water line. Proper maintenance of flows with weirs could prevent this.

6.5.2.4 Compensation for Loss of Trapping Income

If the effects of regulation are detrimental to individual traplines, monetary or work compensation should be considered.

6.5.3 Rat-Burntwood Diversion

This section discusses the major types of mitigation that should be considered to decrease the impact of diversion of the Churchill River through the Rat and Burntwood Rivers.

6.5.3.1 Determination of Optimal Water Regimes

Water levels and flows should be regulated to speed shoreline re-establishment and minimize damage to wildlife and wildlife habitat. All possible attempts should be made at keeping rises or drops in water after fall freeze-up to less than two feet, to avoid destruction of aquatic furbearers.

6.5.3.2 Clearing

Several guidelines for clearing to serve wildlife purposes were previously submitted to the Study Board. These same recommendations are submitted below:

Reasons for Clearing

1. To replace wildlife habitat lost through flooding with new, potentially productive habitat.

2. To speed processes which could take up to 100 years and leave large areas unproductive until natural forces complete re-establishment of shorelines and marshes.

Guidelines (General)

1. When any clearing is done, wildlife values should be kept in mind.

2. Clear to create habitat on an acre-for-acre basis, i.e., one acre created for one acre of prime habitat lost through flooding.

3. Where possible, slash and burn to 2' above proposed water level to speed re-establishment of shorelines. Rooted aquatic plants and willows will colonize cleared areas faster and more extensively. Animals also respond quickly to creation of this new habitat. Some animals could also benefit from slash piles left above floodline. Low relief shorelines are more valuable to wildlife, but slower to re-establish by natural processes after flooding. Clearing these shorelines will be most beneficial.

4. Clear islands to 2' above shoreline wherever possible, as these areas are important to nesting waterfowl.

5. Leave nesting sites of eagles and ospreys.

6. Potentially productive bays should not be used for booms as these bays will be largely lost to wildlife production until sunlight and space become available for rooted aquatics to grow.

7. Clear flatlands where water will be shallow over extensive areas and good potential for marsh development exists.

8. If a traditional large ungulate crossing path is identified, clear to allow access.

6.5.3.4 Diking

Consideration should be given to diking certain areas for maintenance of present productive wildlife habitat. The large area west of Issett Lake would be a prime consideration for such mitigation measures. It has high wildlife potential with proper manipulations of water levels. Much of this area is treed muskeg, which when flooded and not cleared will not be highly productive of waterfowl, big game or furbearers.

6.5.3.5 Compensation for Loss of Trapping Income

There will be a potential loss of income to trappers of Nelson House from the flooding of shorelines in thirty RTL's. Losses will be greatest in RTL's close to the community. Compensation for loss of income to trappers should be considered. This could be in the form of financial aid or preferably through equivalent alternatives. Compensation could be based on the area flooded in each RTL (Table 37). Those trappers who are seriously affected may be granted trapping privileges on RTL's which are currently under-utilized. Revision of trapline boundaries should also be considered. Transportation should be facilitated whenever possible so that trappers can still get to their RTL's. A bypass at Notigi should be considered, so that natives can move their boats to the reservoir. Building of winter roads is also a possibility.

Alternative employment in other resource based industries could be offered. Areas of employment could include pulp cutting, timber clearing or other construction related activities.

A fur management plan should be developed for the area to increase production. Some traplines appear to be under-utilized at present. A continuing program of trapper education and further support for the fur co-operative would be helpful in realizing better fur returns. Fur handling and quality would be upgraded and trapper efficiency increased. Motivation among trappers would be higher if prices from fur sales were at least equivalent to prices obtained at Winnipeg auction houses.

6.5.3.6 Game Harvest Control

A managment plan should be devised to regulate the harvest of moose in areas readily accessible to recreational hunters. Residents of Nelson House should be allowed to harvest the number of moose required for their use without interference from recreational hunters. Such a management plan could involve setting quotas, restricting open seasons or closing certain areas to recreational hunters. Closing the region of the Diversion between Notigi and Birch Tree Lake to recreational hunters should be considered. The area north of Nelson House up to Leftrook Lake could also be considered as a closed area. Regulation of the native moose harvest may become necessary.

A system of collecting moose harvest data from residents of the community has been initiated and should be continued. The location of all moose kills, and areas favoured for hunting by residents should be determined each year. A study of resident utilization of ungulates would be useful. The role of wildlife as a source of food for residents of the community should be determined by such a study.

6.5.3.7 Avoiding Harassment of Wildlife

Proper incineration of refuse and litter would reduce the attraction of bears and wolves to camp areas and thereby minimize disturbance to wildlife.

All employees involved in construction and related activities, especially pilots, should be instructed to avoid harassment of waterfowl, nesting colonies, eagles and ospreys, moose and caribou.

PART 7

APPENDICES

APPENDIX 1

FIELD ACTIVITIES - 1972 - 1974*

LAKE WINNIPEG

Date	Method	Information Obtained	Area Surveyed
June 6	Fixed wing	Waterfowl survey	Netley-Libau marsh, smaller marshes along lakeshore.
June 8	Canoe, ground	Shoreline bird survey	Folster Lake
July 21	Fixed wing	Location and description of nesting colonies, reconnaissance of marshes	Southern portion of Lake, to Reindeer Island.
July 22	Fixed wing	Ground check of nesting colonies.	Pipestone Rock

LOWER CHURCHILL RIVER

Date	Method	Information Obtained	Area Surveyed
June 20	Fixed wing	Reconnaissance, shoreline waterfowl survey	Missi Rapid to Billard Lake
June 24	Boat	Shoreline bird survey	Marsh and shoreline below Missi Rapid
August 4	Helicopter	Canada Goose Survey	Missi Rapid to Billard Lake
August 9	Fixed wing	Reconnaissance, Canada Goose Survey	Billard Lake to Churchill
Sept. 28	Fixed wing	Waterfowl staging survey	Billard Lake to Missi Rapid

RAT-BURNTWOOD DIVERSION

Date	Method	Information Obtained	Area Surveyed
Sept.22/72	Fixed wing	Waterfowl staging survey	Thompson to Threepoint Lake
June 12,14	Fixed wing	Reconnaissance	Total Diversion Route
June 14,15	Fixed wing	Shoreline waterfowl survey	Total Diversion Route

*all dates are 1973 unless otherwise indicated

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RAT-BURNTWOOD DIVERSION - Cont'd

Date	Method	Information Obtained	Area Surveyed
July 30	Fixed wing	Reconnaissance, waterfowl brood survey, moose habitat.	Thompson to South Bay
Aug. 2	Boat	Shoreline brood survey	Birch Tree Lake, Burntwood River to Kepuche Falls
Aug. 7	Boat	Shoreline brood survey	Rat River, Rat Lake to Misinagu Lake
Aug. 27	Boat	Shoreline brood survey, moose browse plots	Burntwood River, Thompson to Apussigamasi Lake
Aug. 28	Fixed wing	Moose browse plots	Birch Tree, Wuskwatim, Threepoint Lakes
Aug. 30	Boat	Shoreline brood survey moose browse plots	Karsakawugimak Lake, Upper Rat River to rapids.
Sept. 7	Fixed wing	Waterfowl staging survey	Total Diversion Route
Sept. 26	Fixed wing	Waterfowl staging survey	Total Diversion Route
Feb. 23, 24/74	Fixed wing	Winter moose survey	Thompson to South Bay
March 15, 1974	Interviews	Furbearer information	Nelson House trappers

APPENDIX 2
LAKE WINNIPEG
WATERFOWL SURVEY FLIGHT DATA, June 6, 1973*

Time of Survey	0810 - 1220
Temperature	49 - 60° F
Wind	5 - 15 m.p.h., NNW
% Cloud	70, decreasing to 30
Precipitation	nil
Visibility	Good-excellent
Air Speed	80 - 85 m.p.h.
Altitude	100 feet
Transect width	1/4 mile
Aircraft	Cessna 172

*See Map 1

APPENDIX 3
LOWER CHURCHILL RIVER
WATERFOWL SURVEY FLIGHT DATA, 1973

	June 20	August 4	August 9	September 28
Time of Survey	1030-1240	0830-1130 1315-1535	1630-1930	1030-1210
Temperature	55-70° F	60° F	50° F	50° F
Wind	0-10 m.p.h.	5 m.p.h.	20 m.p.h.	15-20 m.p.h.
% Cloud	10-30	Varied	30	100
Precipitation	Nil	Nil	Nil	Nil
Visibility	Excellent	Excellent	Good	Good
Air Speed	90 m.p.h.	60-100 m.p.h.	85-100 m.p.h.	100 m.p.h.
Altitude	100-200 feet	50-100 feet	100-200 feet	200 feet
Aircraft	Cessna 180	Bell 206B	Cessna 180	Cessna 180

APPENDIX 4

RAT-BURNTWOOD DIVERSION
WATERFOWL SURVEY FLIGHT DATA, 1973

	June 14	June 15	June 17	September 7	September 26
Time of survey	0700-0840	0620-0825	1000-1030	1210-1445, 1535-1610	1005-1325, 1455-1545
Temperature	35 - 55° F.	35 - 55° F.	55° F.	60° F.	60° F.
Wind	nil	10 - 15 mph	10 mph	5 mph	10 - 15 mph
% Cloud	10	10	90	10 - 40	10
Precipitation	nil	nil	nil	nil	nil
Visibility	good	good	good	good	excellent
Air speed	120 mph	120 mph	95 mph	110-120 mph	85 - 105 mph
Altitude	200-300 feet	200-300 feet	100-250 feet	150-300 feet	100-200 feet
Aircraft	Cessna 337	Cessna 337	Beaver	Cessna 337	Cessna 180

APPENDIX 5

RAT-BURNTWOOD DIVERSION
MOOSE TRANSECT SURVEY
FLIGHT DATA*

	February 23, 1974	February 24, 1974
Time of survey	1045-1415	1025-1300, 1400-1515
Temperature	15°F	15°F
Wind	light	15 mph
% Cloud	10	10
Precipitation	nil	nil
Visibility	excellent	excellent
Air Speed	95-104 mph	90 mph
Altitude	500-600 ft.	300-400 ft.
Transect width**	1/5 mile	1/6 mile
Aircraft	Cessna 337	Cessna 180

* See Appendix 6

** Effective transect width - coverage with one observer on each side, less area under aircraft.

APPENDIX 8

A TENTATIVE CHECKLIST OF BIRDS IN THE LOWER CHURCHILL RIVER AREA

Common Loon
Arctic Loon
Red-throated Loon
Horned Grebe
Pied-billed Grebe
American Bittern
Whistling Swan***
Canada Goose
Mallard
Black Duck
Pintail
Green-winged Teal
Blue-winged Teal**
American Widgeon
Shoveler
Greater Scaup***
Lesser Scaup
Common Goldeneye
Bufflehead
Oldsquaw***
Common Eider***
King Eider***
White-winged Scoter
Surf Scoter
Common Merganser
Red-breasted Merganser
Goshawk
Red-tailed Hawk**
Rough-legged Hawk***
Bald Eagle
Marsh Hawk
Osprey*
Peregrine Falcon
Pigeon Hawk
Sparrow Hawk*
Spruce Grouse
Ruffed Grouse*
Willow Ptarmigan
Sharp-tailed Grouse**
Sandhill Crane**
Sora
Yellow Rail
Semipalmated Plover
Killdeer
American Golden Plover
Common Snipe
Whimbrel***
Spotted Sandpiper
Solitary Sandpiper
Greater Yellowlegs
Lesser Yellowlegs
Pectoral Sandpiper***
Least Sandpiper
Dunlin***
Short-billed Dowitcher

* - probable (Godfrey 1970)
** - possible (Godfrey 1970)
*** - along Hudson Bay coast

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Stilt Sandpiper***
Semipalmated Sandpiper***
Hudsonian Godwit***
Northern Phalarope
Parasitic Jaeger***
Herring Gull
Bonaparte's Gull
Common Tern
Arctic Tern***
Black Tern***
Great Horned Owl
Snowy Owl***
Hawk Owl
Great Gray Owl
Short-eared Owl
Boreal Owl
Common Nighthawk
Yellow-shafted Flicker
Hairy Woodpecker
Downy Woodpecker**
Black-backed Three-toed Woodpecker
Northern Three-toed Woodpecker
Eastern Phoebe**
Yellow-bellied Flycatcher
Traill's Flycatcher
Least Flycatcher*
Olive-sided Flycatcher
Horned Lark
Tree Swallow
Bank Swallow
Barn Swallow**
Cliff Swallow
Gray Jay
Common Raven
Common Crow
Boreal Chickadee
American Robin
Hermit Thrush
Swainson's Thrush*
Gray-cheeked Thrush***
Mountain Bluebird**
Golden-crowned Kinglet**
Ruby-crowned Kinglet
Water Pipit***
Bohemian Waxwing
Northern Shrike
Common Starling
Tennessee Warbler
Orange-crowned Warbler
Yellow Warbler
Myrtle Warbler
Blackpoll Warbler
Palm Warbler
Northern Waterthrush
Wilson's Warbler
House Sparrow
Rusty Blackbird
Common Grackle
Pine Grosbeak
Hoary Redpoll***
Common Redpoll
White-winged Crossbill**

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Savannah Sparrow
Slate-colored Junco
Tree Sparrow
Chipping Sparrow
Harris's Sparrow
White-crowned Sparrow
White-throated Sparrow
Fox Sparrow
Lincoln's Sparrow
Swamp Sparrow
Song Sparrow
Lapland Longspur***
Smith's Longspur***

APPENDIX 9

A TENTATIVE CHECKLIST OF BIRDS BREEDING IN THE RAT-BURNTWOOD DIVERSION AREA

Common Loon
Red-necked Grebe**
Horned Grebe
Pied-billed Grebe
American Bittern
Canada Goose
Mallard
Black Duck**
Pintail
Green-winged Teal
Blue-winged Teal
American Widgeon
Shoveler
Ring-necked Duck
Lesser Scaup
Common Goldeneye
Bufflehead
White-winged Scoter
Surf Scoter
Hooded Merganser**
Common Merganser
Red-breasted Merganser
Goshawk
Sharp-shinned Hawk*
Red-tailed Hawk
Bald Eagle
Marsh Hawk
Osprey
Peregrine Falcon
Pigeon Hawk
Sparrow Hawk
Spruce Grouse
Ruffed Grouse
Sharp-tailed Grouse**
Sandhill Crane**
Sora
Yellow Rail
Killdeer
Common Snipe
Spotted Sandpiper
Solitary Sandpiper
Greater Yellowlegs
Lesser Yellowlegs
Short-billed Dowitcher
Herring Gull
Ring-billed Gull
Bonaparte's Gull
Common Tern
Caspian Tern
Black Tern **
Great Horned Owl
Hawk Owl
Great Gray Owl
Long-eared Owl**
Short-eared Owl
Boreal Owl
Common Nighthawk
Kingfisher**
Yellow-shafted Flicker
Pileated Woodpecker
Yellow-bellied Sapsucker
Hairy Woodpecker
Downy Woodpecker

* - probable (Godfrey 1970)
** - possible (Godfrey 1970)

APPENDIX 9 (Cont'd)

Black-backed Three-toed Woodpecker
Northern Three-toed Woodpecker
Eastern Phoebe
Yellow-bellied Flycatcher
Traill's Flycatcher
Least Flycatcher
Olive-sided Flycatcher
Horned Lark **
Tree Swallow
Bank Swallow
Cliff Swallow
Gray Jay
Common Raven
Common Crow
Black-capped Chickadee
Boreal Chickadee
Red-breasted Nuthatch**
American Robin
Hermit Thrush
Swainson's Thrush
Golden-crowned Kinglet**
Ruby-crowned Kinglet
Bohemian Waxwing
Cedar Waxwing
Red-eyed Vireo
Tennessee Warbler
Orange-crowned Warbler
Yellow Warbler
Magnolia Warbler
Myrtle Warbler
Blackpoll Warbler
Palm Warbler
Northern Waterthrush
Wilson's Warbler
House Sparrow
Red-winged Blackbird
Rusty Blackbird
Common Grackle
Pine Grosbeak
White-winged Crossbill
Savannah Sparrow
Le Conte's Sparrow
Slate-colored Junco
Tree Sparrow
Chipping Sparrow
White-crowned Sparrow
White-throated Sparrow
Fox Sparrow
Lincolns' Sparrow
Swamp Sparrow
Song Sparrow

APPENDIX 10

RAT-BURNTWOOD DIVERSION MOOSE BROWSE SURVEY

Plot No.	Location	SHORELINE* Major species **	SHORELINE* Utilization	BACKSHORE * Major species	BACKSHORE * Utilization
1	Apussigamasi Lake	willow (90%) sedge (20%)	willow (5%)	aspen (55%) spruce (5%) rose (10%) willow (10%)	-
2	Apussigamasi Lake	alder (25%) willow (10%) bunchberry (10%)	-	spruce (50%) birch (30%) juniper (20%)	-
3	Apussigamasi Lake	aspen (90%) fireweed (20%) willow (10%)	-	aspen (95%) fireweed (20%)	-
4	Birch Tree Lake	willow (20%) aspen (20%) alder (20%)	willow (80%)	aspen (50%) alder (25%) fireweed (25%)	aspen (2%) alder (30%)
5	Wuskwatim Lake	aspen (40%) fireweed (15%)	-	fireweed (65%) aspen (45%) alder (10%)	aspen (10%)
6	Threepoint Lake	willow (25%) alder (25%)	-	alder (50%) fireweed (35%) birch (15%) aspen (15%)	-

*Shoreline plot - on the immediate shoreline
Backshore plot - behind the existing shoreline vegetation

**Major spp. - making up 10% or more of the vegetation in a plot

APPENDIX 10 (page 2)

Plot No.	Location	SHORELINE* Major species**	SHORELINE* Utilization	BACKSHORE* Major species	BACKSHORE* Utilization
7	Karsakuwigamak Lake	alder (45%) willow (10%) bunchberry (10%) aspen (10%) spruce (10%) rose (10%)	-	spruce (45%) juniper (20%) labrador tea (50%)	-
8	Karsakuwigamak Lake	willow (95%) sedge (20%)	willow (5%)	not done	
9	Upper Rat River	willow (40%) rose (40%) cranberry (40%) birch (20%)	-	birch (60%) spruce (40%) labrador tea (30%)	-
10	Upper Rat River	willow (75%) birch (25% cranberry (10%) rose (10%)	willow-trace	willow (90%) alder (10%) sedge (10%)	willow (15%)
11	Upper Rat River	willow (70%) birch (30%) cranberry (10%) rose (10%)	willow-trace	not done	
12	Upper Rat River	willow (30%) birch (30%) alder (30%)	-	spruce forest	-

APPENDIX 11

AVERAGE PELT VALUES* - MANITOBA
1967/68 - 1972/73

YEAR	BEAVER	ERMINE	CROSS FOX	RED FOX	SILVER FOX	LYNX
1967/68	$18.00	1.48	9.83	8.08	14.66	32.66
1968/69	22.00	2.43	16.50	14.50	18.00	41.00
1969/70	19.00	.98	18.00	10.00	12.00	30.00
1970/71	14.09	.52	21.90	12.40	10.00	29.50
1971/72	18.18	.74	19.98	15.15	12.00	39.31
1972/73	20.05	1.03	43.93	29.40	22.60	90.15

YEAR	MARTEN	MINK	MUSKRAT	OTTER	SQUIRREL	WOLVERINE
1967/68	7.66	16.00	1.01	19.00	.51	26.00
1968/69	9.75	17.00	1.55	32.50	.40	52.50
1969/70	10.00	13.00	1.45	33.00	.25	57.00
1970/71	8.15	11.20	1.57	31.50	.25	70.40
1971/72	8.46	19.32	2.01	37.62	.52	84.65
1972/73	8.66	23.40	2.64	39.68	.96	87.80

*Average values per pelt, Winnipeg prices.

APPENDIX 12 (A-C)

FUR HARVEST; CHURCHILL, SPLIT LAKE AND SOUTHERN INDIAN LAKE REGISTERED TRAPLINE SECTIONS

(1967-68 to 1971-72)

This appendix presents the fur harvest data for Registered Traplines in the above Registered Trapline Sections which will be directly affected along the Lower Churchill River. Numbers of pelts and values are given for each of the four major species: beaver, lynx, mink and muskrat. Values of all other pelts are also given.

Values were calculated using prices listed in Appendix 11, using fur harvest data from DMREM, The Pas, Manitoba.

APPENDIX 12A

FUR HARVEST, CHURCHILL REGISTERED TRAPLINE SECTION

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
						1967-68					
2	1	11	198	-	-	2	32	32	32	171	433
11	1	8	144	2	65	8	128	103	104	142	583
						1968-69					
2	1	10	220	-	-	6	102	44	68	30	420
11	1	4	88	-	-	8	136	20	31	52	307
12	1	-	-	-	-	3	51	19	29	160	240
14	1	-	-	-	-	3	51	-	-	65	116
16	1	-	-	-	-	-	-	-	-	-	48
						1969-70					
11	1	4	76	-	-	5	65	62	90	56	287
CL	1	28	532	2	60	3	39	-	-	105	736
						1970-71					
11	1	1	14	2	59	9	109	-	-	107	281
CL	1	-	-	-	-	-	-	-	-	38	38

APPENDIX 12A - Page 2

1971-72

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
2	1	1	18	-	-	-	-	-	-	-	18
11	1	1	18	-	-	1	19	-	-	3	40
12	1	1	18	-	-	5	96	-	-	243	357
CL	3	3	54	-	-	-	-	-	-	123	177

APPENDIX 12B

FUR HARVEST, SPLIT LAKE REGISTERED TRAPLINE SECTION

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
1967-68											
38	2	38	684	-	-	20	320	24	24	41	1,069
39	2	17	306	-	-	2	32	2	2	18	358
46	1	74	1,332	1	32	10	160	7	7	20	1,551
52	1	10	180	-	-	7	112	-	-	-	292
53	1	13	234	-	-	2	32	-	-	-	266
1968-69											
38	2	63	1,386	-	-	32	544	16	25	97	2,052
39	3	186	4,092	-	-	38	646	11	17	178	4,933
46	1	58	1,276	-	-	20	340	8	12	13	1,641
52	1	5	110	-	-	2	34	38	59	15	218
53	1	24	528	4	164	14	238	-	-	65	995
1969-70											
38	2	71	1,349	11	330	41	533	-	-	77	2,289
39	3	63	1,197	-	-	21	273	11	16	82	1,568
46	1	66	1,254	-	-	-	-	20	29	-	1,283
53	1	34	646	-	-	9	117	35	51	20	834

APPENDIX 12B - Page 2

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
						1970-71					
38	2	27	378	3	88	-	-	3	4	31	501
39	2	19	266	2	59	10	112	5	8	38	483
46	1	13	182	-	-	1	11	5	8	-	201
52	1	12	168	7	206	8	89	-	-	-	463
						1971-72					
38	2	40	720	-	-	9	173	2	4	72	969
39	2	54	972	3	118	2	38	64	128	218	1,474
46	1	18	324	-	-	-	-	14	28	-	352
52	1	2	36	-	-	-	-	-	-	-	36
53	1	21	378	5	196	5	96	5	10	104	784

APPENDIX 12C

FUR HARVEST, SOUTHERN INDIAN LAKE REGISTERED TRAPLINE SECTION

1967-68

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
11	1	15	270	-	-	10	160	68	68	54	552
12	1	90	1,620	2	65	22	352	68	68	159	2,264
13	4	140	2,520	2	65	9	144	166	167	66	2,962
						1968-69					
11	1	18	396	1	41	17	289	3	4	215	945
12	1	64	1,408	4	164	62	1,054	43	66	466	3,158
13	1	-	-	-	-	1	17	-	-	-	17
14	1	-	-	-	-	59	1,003	-	-	227	1,230
						1969-70					
10	1	27	513	-	-	-	-	26	37	-	550
11	1	6	114	-	-	9	117	-	-	33	264
13	2	36	684	2	60	23	299	-	-	147	1,190
14	1	1	19	-	-	6	78	-	-	43	140

APPENDIX 12C - Page 2

1970-71

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
10	1	-	-	-	-	-	-	-	-	31	31
12	3	66	930	-	-	3	33	-	-	35	998
13	2	41	577	-	-	5	56	-	-	69	702
14	1	-	-	-	-	3	33	-	-	31	64

1971-72

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
10	2	2	36	-	-	-	-	-	-	-	36
12	1	46	836	-	-	2	38	52	104	414	1,392
13	1	70	1,272	1	39	-	-	33	66	138	1,515

APPENDIX 13 (A-E)

FUR HARVEST; NELSON HOUSE REGISTERED TRAPLINE SECTION

(1967-68 to 1971-72)

This appendix presents the fur harvest data for Registered Traplines in the Nelson House Registered Trapline Section which will be directly affected along the Rat-Burntwood Diversion. Numbers of pelts and values are given for each of the four major species: beaver, lynx, mink and muskrat. Values of all other pelts are also given.

Values were calculated using prices listed in Appendix 11 , using fur harvest data from DMREM, The Pas, Manitoba.

APPENDIX 13A

FUR HARVEST, NELSON HOUSE REGISTERED TRAPLINE SECTION

1967-68

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
2/3	1	21	378	-	-	-	-	-	-	92	470
4	3	45	810	4	130	4	64	68	68	56	1,128
9	1	16	288	7	228	1	16	96	97	-	629
12	5	93	1,674	12	391	34	544	496	501	224	3,334
18	3	90	1,620	8	261	11	176	3	3	63	2,123
26	2	49	882	-	-	20	320	-	-	39	1,241
27	1	17	306	-	-	-	-	-	-	19	325
28	4	56	1,008	-	-	1	16	15	15	60	1,099
29	1	23	414	-	-	-	-	40	40	16	470
30	1	23	414	3	98	4	64	-	-	40	616
33	3	172	3,096	41	1,336	65	1,040	461	465	346	6,283
34/35	4	65	1,170	11	358	22	352	121	122	83	2,085
36	2	54	972	-	-	4	64	38	38	30	1,104
37	4	57	1,026	5	163	11	176	48	48	200	1,613
38	1	14	252	3	98	-	-	3	3	65	418
31	1	28	504	1	32	12	192	8	8	48	784

APPENDIX 13A - Page 2

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
39	8	113	2,034	12	391	9	144	98	99	63	2,731
40	5	42	756	3	98	21	336	143	144	64	1,398
42	1	10	180	8	261	-	-	5	5	20	466
47	2	6	108	-	-	1	16	3	3	23	150
(Community Line)											
49	9	63	1,134	23	750	33	528	222	224	477	3,113
53A	1	-	-	1	32	-	-	-	-	61	93

APPENDIX 13B

FUR HARVEST, NELSON HOUSE REGISTERED TRAPLINE SECTION

1968-69

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
2/3	1	4	88	-	-	4	68	-	-	4	160
4	5	66	1,452	48	1,968	9	153	18	28	73	3,674
5	3	31	682	7	287	4	68	19	29	6	1,072
8	1	36	792	9	369	8	136	3	4	104	1,405
9	1	50	1,100	7	287	4	68	22	34	14	1,503
12	5	60	1,320	60	2,460	53	901	342	530	214	5,425
18	1	46	1,012	1	41	10	170	60	93	97	1,413
26	3	98	2,156	56	2,296	18	306	5	8	90	4,856
27	2	30	660	-	-	-	-	128	198	32	890
28	5	120	2,640	25	1,025	40	680	13	20	199	4,564
29	1	3	66	-	-	-	-	63	97	-	163
30	2	129	2,838	26	1,066	9	153	69	107	74	4,238
32	4	44	968	9	369	38	646	116	180	179	2,342
33	3	87	1,914	29	1,189	87	1,479	218	338	181	5,101
34/35	4	104	2,288	34	1,394	10	170	2	3	9	3,864
36	2	80	1,760	44	1,804	18	306	6	9	166	4,045
37	4	61	1,342	12	492	7	119	123	190	27	2,170
31	2	53	1,666	9	369	10	170	34	53	193	1,951

APPENDIX 13B - Page 2

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
38	1	49	1,078	11	451	11	187	83	128	145	1,989
39	8	378	8,316	63	2,583	35	595	63	97	149	11,740
40	4	60	1,320	25	1,025	9	153	101	156	1	2,655
41	1	32	704	9	369	2	34	-	-	-	1,107
42	2	21	462	10	410	7	119	-	-	82	1,073
47	2	50	1,100	14	574	5	85	108	167	140	2,066
(Community Line) 49	11	76	1,672	38	1,558	31	527	201	311	322	4,390
60	1	91	2,002	13	533	35	595	44	68	128	3,326
53A		6	132	-	-	5	85	7	11	7	235

APPENDIX 13C
FUR HARVEST, NELSON HOUSE REGISTERED TRAPLINE SECTION
1969-70

RTL No.	No. Active Trappers	Beaver No.	Beaver $ Value	Lynx No.	Lynx $ Value	Mink No.	Mink $ Value	Muskrat No.	Muskrat $ Value	Others $ Value	Total Value
2/3	3	36	684	11	330	1	13	-	-	-	1,027
4	3	32	608	9	270	-	-	11	16	2	896
5	2	29	551	23	690	4	52	20	29	-	1,322
9	2	21	399	8	240	10	130	21	30	107	906
12	5	85	1,615	44	1,320	15	195	354	513	10	3,653
18	1	37	703	3	90	2	26	12	17	101	937
26	2	16	304	-	-	-	-	32	46	33	383
27	3	62	1,178	20	600	10	130	145	210	57	2,175
28	3	25	475	7	210	1	13	54	78	-	776
29	1	20	380	-	-	1	13	-	-	-	393
30	1	55	1,045	22	660	2	26	-	-	57	1,788
32	3	31	589	2	60	22	286	135	195	33	1,163
33	3	47	893	45	1,350	37	481	49	71	170	2,965
34/35	2	30	570	16	480	4	52	6	8	67	1,177
36	2	49	931	21	630	9	117	52	75	71	1,824
37	3	23	437	2	60	9	117	24	35	4	653
38	2	41	779	14	420	8	104	14	20	18	1,341
31	2	48	912	6	180	4	52	-	-	72	1,216

APPENDIX 13C- Page 2

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
39	8	142	2,698	56	1,680	12	156	27	39	12	4,585
40	5	92	1,748	24	720	6	78	57	82	3	2,631
41	1	1	19	-	-	-	-	31	45	-	64
42	2	10	190	4	120	-	-	33	48	-	358
47	3	62	1,178	14	420	2	26	6	8	35	1,667
(Community Line) 49	14	93	1,767	40	1,200	25	325	213	309	209	3,810
60	1	55	1,045	51	1,530	78	1,014	-	-	57	3,646
53B	1	-	-	-	-	1	13	-	-	-	13

APPENDIX 13D

FUR HARVEST, NELSON HOUSE REGISTERED TRAPLINE SECTION

1970-71

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat			
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	Total Value
4	2	6	84	4	118	-	-	24	37	53	292
5	2	22	308	17	50	-	-	3	4	-	362
9	1	18	252	7	206	-	-	-	-	39	497
12	5	74	1,036	13	383	6	67	257	403	129	2,018
28	2	59	826	8	236	1	11	-	-	63	1,136
29	1	14	196	-	-	-	-	-	-	31	227
30	2	91	1,274	4	118	-	-	70	110	76	1,578
32	1	56	504	12	354	4	45	41	64	44	1,011
33	4	145	2,030	68	2,006	7	87	219	344	245	4,703
34/35	1	31	434	4	118	-	-	58	91	70	713
36	1	68	952	7	206	2	22	21	33	101	1,314
37	4	61	854	6	177	1	11	104	163	136	1,341
38	1	73	1,022	4	118	3	33	69	108	176	1,457
39	6	110	1,540	51	1,504	10	112	119	186	131	3,473
40	2	31	434	8	236	4	45	133	208	34	957
31	1	43	602	4	118	-	-	35	55	128	903

APPENDIX 13D - Page 2

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
41	1	1	14	11	324	-	-	-	-	-	338
47	1	78	1,092	9	265	1	11	63	99	126	1,593
(Community Line)											
49	12	75	1,050	32	944	9	111	152	238	196	2,539
53A	1	6	84	-	-	-	-	-	-	-	84
60	1	71	994	24	708	16	179	5	8	181	2,070

APPENDIX 13E

FUR HARVEST, NELSON HOUSE REGISTERED TRAPLINE SECTION

1971-72

RTL No.	No. Active Trappers	Beaver No.	Beaver $ Value	Lynx No.	Lynx $ Value	Mink No.	Mink $ Value	Muskrat No.	Muskrat $ Value	Others $ Value	Total Value
2/3	1	4	72	-	-	-	-	1	2	-	74
4	2	20	360	12	471	-	-	64	128	37	996
5	1	5	90	-	-	-	-	-	-	-	90
8	1	2	36	-	-	-	-	-	-	-	36
9	2	13	234	8	314	-	-	12	24	37	609
12	4	76	1,368	49	1,925	6	116	390	784	180	4,373
18	1	1	18	-	-	-	-	62	124	-	142
26	1	9	162	-	-	-	-	37	74	75	311
27	1	27	486	-	-	-	-	134	269	37	792
28	2	52	936	21	825	4	77	77	154	284	2,276
29	2	71	1,278	18	707	7	135	-	-	184	2,304
30	2	119	2,142	32	1,257	4	77	71	142	272	3,890
33	2	1	18	13	511	2	38	1	2	32	601
34/35	2	44	792	14	550	7	135	146	293	121	1,891
36	2	44	792	5	196	4	77	71	142	37	1,244
37	3	23	414	3	118	-	-	35	70	37	639
38	1	23	414	2	78	2	38	137	275	111	916
31	1	6	108	-	-	-	-	30	60	-	168

APPENDIX 13E - Page 2

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
39	9	139	2,502	39	1,532	4	77	159	319	552	4,982
40	3	42	756	5	196	-	-	253	508	39	1,499
41	1	14	252	1	39	-	-	40	80	37	408
42	2	16	288	13	511	1	19	6	12	2	832
47	1	19	342	11	432	1	19	44	88	271	1,152
(Community Line) 49	12	109	1,962	31	1,218	10	193	350	703	296	4,372
60/61	1	4	72	18	707	35	675	4	8	218	1,680

APPENDIX 14 (A-D)

FUR HARVEST; SOUTHERN INDIAN LAKE, SPLIT LAKE, THICKET PORTAGE, AND PIKWITONEI REGISTERED TRAPLINE SECTIONS

(1967-68 to 1971-72)

This appendix presents the fur harvest data for Registered Traplines in the above Registered Trapline Sections which will be directly affected along the Rat-Burntwood Diversion. Numbers of pelts and values are given for each of the four major species: beaver, lynx, mink and muskrat. Values of all other pelts are also given.

Values were calculated using prices listed in Appendix 11 , using fur harvest data from DMREM, The Pas, Manitoba.

APPENDIX 14A

FUR HARVEST, SOUTHERN INDIAN LAKE REGISTERED TRAPLINE SECTION

RTL No.	No. Active Trappers	Beaver No.	Beaver $ Value	Lynx No.	Lynx $ Value	Mink No.	Mink $ Value	Muskrat No.	Muskrat $ Value	Others $ Value	Total Value
					1967/68						
3	-	-	-	-	-	-	-	-	-	-	-
4	3	137	2,466	1	32	6	96	597	603	168	3,365
					1968/69						
3	2	99	2,178	5	205	8	136	252	390	7	2,916
4	5	138	2,036	18	738	20	340	647	1,003	69	4,186
					1969/70						
3	1	19	361	5	150	4	52	-	-	33	596
4	6	87	1,653	56	1,680	26	338	458	664	431	4,766
					1970/71						
3	2	61	859	2	59	2	22	29	45	25	1,010
4	4	93	1,310	40	1,180	16	179	456	716	163	3,548
					1971/72						
3	1	34	618	5	196	6	116	4	8	102	1,040
4	5	40	727	14	550	3	58	169	339	98	1,772

APPENDIX 14B

FUR HARVEST, SPLIT LAKE REGISTERED TRAPLINE SECTION

RTL No.	No. Active Trappers	Beaver No.	Beaver $ Value	Lynx No.	Lynx $ Value	Mink No.	Mink $ Value	Muskrat No.	Muskrat $ Value	Others $ Value	Total Value
1967/68											
11	3	82	1,476	2	65	21	336	131	132	93	2,102
12	1	42	756	6	196	23	368	71	71	65	1,456
70 (w̄ 68)	-	-	-	-	-	-	-	-	-	-	-
1968/69											
11	4	74	1,628	12	492	32	544	42	65	50	2,779
12 (w̄ 68)	1	64	1,408	8	328	36	612	18	28	160	2,536
70 (& 72)	1	99	2,178	5	205	9	153	25	39	104	2,679
1969/70											
11	1	37	703	11	330	14	182	26	37	96	1,348
12	1	3	57	1	30	1	13	-	-	10	110
70 (& 72)	1	70	1,330	4	120	26	338	29	42	66	1,896
1970/71											
11	2	44	620	10	295	3	33	10	15	126	1,089
12	2	50	704	51	1,504	6	67	68	107	181	2,563
70 (& 72)	1	57	803	9	265	1	11	5	8	315	1,402
1971/72											
11	1	43	782	10	393	3	58	48	96	104	1,433
12	4	64	1,163	18	707	8	154	47	94	112	2,230
70	1	34	618	3	118	2	38	6	12	190	976

APPENDIX 14C

FUR HARVEST, THICKET PORTAGE SECTION REGISTERED TRAPLINE SECTION

RTL No.	No. Active Trappers	Beaver No.	Beaver $ Value	Lynx No.	Lynx $ Value	Mink No.	Mink $ Value	Muskrat No.	Muskrat $ Value	Others $ Value	Total Value
						1967/68					
32	1	24	432	4	130	10	160	30	30	38	790
						1968/69					
32	1	9	198	14	574	7	119	-	-	9	900
						1969/70					
32	2	19	361	5	150	5	65	15	22	99	697
						1970/71					
32	-	-	-	-	-	-	-	-	-	-	-
						1971/72					
32	-	-	-	-	-	-	-	-	-	-	-

APPENDIX 14D

FUR HARVEST, PIKWITONEI REGISTERED TRAPLINE SECTION

1967/68

RTL No.	No. Active Trappers	Beaver No.	Beaver $ Value	Lynx No.	Lynx $ Value	Mink No.	Mink $ Value	Muskrat No.	Muskrat $ Value	Others $ Value	Total Value
44	1	14	252	8	261	40	640	-	-	33	1,186
60	2	52	936	1	36	5	80	4	4	86	1,142
57	1	126	2,268	43	1,404	76	1,216	88	89	202	5,179
67	3	24	432	5	163	13	208	-	-	1	804

1968/69

RTL No.	No. Active Trappers	Beaver No.	Beaver $ Value	Lynx No.	Lynx $ Value	Mink No.	Mink $ Value	Muskrat No.	Muskrat $ Value	Others $ Value	Total Value
44	1	12	264	20	820	26	442	5	8	5	1,539
60	3	34	748	7	287	11	187	10	15	63	1,300
57	2	140	3,080	97	3,977	119	2,023	19	29	362	9,471
67	3	11	242	12	492	6	102	1	1	32	870

1969/70

RTL No.	No. Active Trappers	Beaver No.	Beaver $ Value	Lynx No.	Lynx $ Value	Mink No.	Mink $ Value	Muskrat No.	Muskrat $ Value	Others $ Value	Total Value
44	1	34	646	23	690	44	572	3	4	247	2,159
60	3	61	1,159	20	600	5	65	13	19	82	1,925
57	2	132	2,508	56	1,680	86	1,118	131	190	197	5,693
67	-	-	-	-	-	-	-	-	-	-	-

1970/71

RTL No.	No. Active Trappers	Beaver No.	Beaver $ Value	Lynx No.	Lynx $ Value	Mink No.	Mink $ Value	Muskrat No.	Muskrat $ Value	Others $ Value	Total Value
44	1	19	267	5	147	-	-	88	138	-	552
60	2	11	155	5	147	-	-	-	-	12	314
57	2	82	1,155	44	1,298	13	145	80	125	589	3,312
67	-	-	-	-	-	-	-	-	-	-	-

APPENDIX 14D- Page 2

1971/72

RTL No.	No. Active Trappers	Beaver		Lynx		Mink		Muskrat		Others	Total Value
		No.	$ Value	No.	$ Value	No.	$ Value	No.	$ Value	$ Value	
44	1	-	-	-	-	4	77	102	205	37	319
60	4	8	145	7	275	2	38	-	-	-	458
57 (w 64)	2	14	254	40	1,572	3	58	-	-	226	2,110
67	-	-	-	-	-	-	-	-	-	-	-

APPENDIX 15

THE HYDROELECTRIC PROJECT

INTRODUCTION

Manitoba Hydro, a crown corporation, is charged with providing electrical service to the people and industry of Manitoba. Historically, accessible large rivers have provided sufficient economical hydro-electric energy to meet this need. Rapidly increasing energy demands have necessitated the continuing development of new and larger generating facilities [illegible] conditions, uncertain supply of fossil fuel [illegible] ect nuclear generation techniques and the obvious potential of Manitoba's northern rivers contributed to the decision to construct hydro-electric generation facilities on the Nelson River. Two assumptions, based on geographical conditions, were made to maximize the benefits of these facilities. Firstly, the natural storage potential of Lake Winnipeg could be used to regulate the flows of the Nelson River and secondly, the most economical method of extracting the energy of the Churchill River would be to divert a large portion of its flow through the Nelson River generating stations.

This report describes the engineering works which facilitate the Churchill River diversion and outlines the initial physical impacts of this project.

PART 1

THE ENGINEERING WORKS

The diversion of the Churchill River into the Nelson River requires the construction of two facilities, an obstruction in the Churchill River's natural channel, and an outlet into the Nelson River drainage. A coincidence of nature provided excellent locations for both structures on Southern Indian Lake. Four potential sites for hydro-electric generating stations have also been identified along the diversion route.

1.1 SOUTHERN INDIAN LAKE AREA STRUCTURES

Two major diversion elements were constructed on Southern Indian Lake, a widening of the Churchill River. Topography and location made the diversion scheme more feasible because the lake is a natural storage reservoir.

1.2 DIVERSION ROUTE STRUCTURES

The water diverted from the Churchill River will flow down the channels of the Rat and Burntwood Rivers entering the Nelson River at Split Lake. Along this route Manitoba Hydro proposes to place four structures including a control dam and generating stations below Notigi Lake. Generating stations are planned for Taskinigup Rapids below Wuskwatim Lake, at Manasan Falls, and at the first rapids above Split Lake.

1.2.1 Notigi Structures

The Notigi Site is located on the Rat River approximately four miles downstream from the outlet of Notigi Lake. Structures proposed for this site include a dam, a controlled spillway and possibly a hydro-electric generation complex. The dam will be constructed of earth and rock fill and will be 90 feet high and 8,000 feet long when completed (Manitoba Hydro 1973). The spillway will be excavated through overburden and bedrock and will be 200 feet wide with lift gates to control outflow. The Rat River will be blocked May 1, 1974 by construction of a cofferdam and controlled flows will not be released at Notigi until November 1975.

During peak construction periods in the winters of 1973-74 and 1974-75, 250 men will be employed at the Notigi Site.

1.2.2 Other Structures

Hydro-electric generation stations have been proposed for three sites downstream from Notigi. Construction of these sites will not commence for some years under the present development sequence. Descriptions of the structures are therefore unavailable.

Construction Camps and Transportation

Each of the diversion elements will be constructed by crews housed in "on site" camps similar to those operated on other Churchill River Diversion projects. The Notigi structures will provide the means for PR 391 to cross the diversion and therefore allweather road access to the site will be maintained.

1.3 CHURCHILL RIVER STRUCTURES

The present hydro-electric development scheme does not include any structures on the Churchill River downstream of Missi Rapid.

1.4 LAKE WINNIPEG CONTROL STRUCTURES

The outflow from Lake Winnipeg will be regulated by a control structure and generating station located on the West channel of the Nelson River at its entrance to Cross Lake. This site, Jenpeg, is now midway in its construction phase with a camp established. An access road has been extended from Highway #391 and an airstrip has been constructed for private and emergency use.

In order to maintain desirable flow characteristics in the shallow waters upstream of Jenpeg, channel improvements are being made. Channels are being hydraulically dredged from Lake Winnipeg into Playgreen Lake and from Playgreen Lake into Kiskittogisu Lake. A shorter channel has been excavated across Mechantis Island and bedrock formations were blasted to clear existing rapids. Inflow to and outflow from Kiskitto Lake will be controlled by a dam and channel system.

PART 2

EFFECTS

The aim and results of the engineering works associated with Churchill River diversion will be altered lake levels and river flows. The initial impacts of construction activities, reservoir formation, and diversion will be followed by the long term effect of the new water regimes and associated natural process. These deviations from historic conditions are described in order that more subtle environmental effects may also be identified.

2.1 SOUTHERN INDIAN LAKE AREA

A significant permanent increase in the level of Southern Indian Lake is a major feature of the diversion scheme. The flow path of the Churchill River through the lake will change and new seasonal lake level fluctuations will occur. Increased human activity and new service facilities will also influence the environment of the lake and surrounding area.

2.2 DIVERSION ROUTE

Major effects along the diversion route will result from greatly increased flows, newly formed reservoirs and construction and clearing activities associated with the projects. Variable discharges of water and fluctuating reservoir levels will occur as the hydroelectric generation facilities are manipulated to meet power demands.

2.2.1 Notigi Site and Reservoir

The most significant effect resulting from the Notigi structures will be formation of a 130 square mile reservoir extending 60 miles north to connect with Southern Indian Lake. During operation the reservoir will experience larger fluctions than Southern Indian Lake. At the dam face the reservoir levels may be as much as 9 ft.

lower than Southern Indian Lake levels. Reservoir depths will exceed 55 feet in those areas where there are presently lakes. The reservoir will flood 101,484 acres (Whiddon, Lamont and Kaye 1973). Manitoba Hydro will clear about 20% of the area (20,000 acres) to ensure proper flow characteristics and to improve aesthetics (Manitoba Hydro 1973). Some bays will be boomed off to contain floating debris. Flows of 30,000 cfs may result in strong currents and may produce unsafe ice conditions in winter. Erratic outflows will influence reservoir levels but at present these fluctuations are undefined.

During the construction phase as many as 250 men may be on site at one time. Future access will be provided by PR 391 at Notigi and by the road to the channel at South Bay. Boat landing sites have been cleared along the anticipated reservoir shorelines.

2.2.2 Downstream

Downstream effects from specific structures cannot at present be determined as the components are still at a planning stage of development.

Recent data indicate that water levels of 810 feet above Wuskwatim Falls and 690 feet above Manasan Falls could be expected with developments. Unusual conditions such as ice jams could increase water levels by as much as an additional 10 feet above Wuskwatim Falls in the Three Point and Footprint Lakes Areas.

For a period of 18 months, commencing in May 1974 the Rat River below Notigi will not receive the normal mean upstream flows of 2,265 c.f.s. This reduction in flow will cause an undetermined drawdown of downstream waters, particularly Wapisu Lake.

After Notigi reservoir is filled and the diversion is in operation the outflow through the system could exceed 30,000 cfs. These flows will raise lake levels by undetermined amounts and increase stream velocities along the diversion. Flows in the Burntwood River at Thompson will be generally increased by 7 to 10 times the mean historic flow. Studies are presently being conducted to describe the anticipated river flow characteristics and to indicate the extent of flooding as a result of both the diversion and proposed impoundments.

2.3 LOWER CHURCHILL RIVER

Effects along the Churchill River below Missi Rapid will occur as a result of greatly decreased average flows. The timing and magnitude of seasonal fluctuations will deviate from historic conditions and this will have both immediate and long term impacts.

2.3.1 Flows

Under regulation the yearly average discharge of the Churchill River below Missi Rapid will be reduced by approximately 75%. However, under extreme conditions the monthly flows could be as little as 4% of historic or as much as the highest historic flows. There is high probability of severe flow fluctuations during the summer months as illustrated below.

SUMMER OUTFLOW FLUCTUATIONS AT MISSI RAPID

Flow Change	MAY		JUNE		JULY		AUGUST		SEPTEMBER	
in cfs	Rise	Drop	Rise	Drop	Rise	Drop	Rise	Drop	Rise	Drop
0-5,000	10%	49%	16%	4%	19%	19%	24%	35%	1%	33%
5,000-10,000	6%		10%		9%	19%	3%	18%	5%	33%
10,000-20,000	16%		43%			28%	2%	28%		26%
20,000-30,000	15%		17%			5%				0
30,000-40,000	2%		4%							2%
40,000-+	2%		6%							

Winter flow fluctuations will be more moderate with a general decrease in discharge from October at 8,500 cfs to March at 1,500 cfs.

The downstream flows also will fluctuate more widely and at different times than under natural conditions. Average fluctuations in mean monthly flows will be two to three times greater than historic and peaks will occur weeks earlier, i.e. June and July instead of August. Under regulation maximum flows may be similar to historic maximums but two peaks will be expected - one in June and one in October.

Downstream inputs which may seasonally reach 3,000 cfs (Water Resources, Planning Division 1971) will not be affected by the project. Their inputs and channel morphometry will modify the flow patterns released upstream. However, the effect of significant decreases in total flows and the timing and magnitude of flow fluctuations will be evident downstream to the mouth of the Churchill River.

2.3.2 Lake Levels and Volumes

Reduced flows in the Churchill River will cause levels and volumes of downstream lakes to decrease. Partridge Breast, Northern Indian, Fidler and Billard Lakes will experience significant reductions in depth, volume and surface area. Table 31 (page 114) was prepared using the level and flow data provided by Manitoba Water Resources Branch in 1974, and the surface area and storage curves prepared by Water Resources Branch, Planning Division in 1971.

Seasonal level fluctuations will reflect the flow fluctuations as typified by Northern Indian Lake levels.

2.3.3 Ice

Reduction in mean flows and changes in timing and magnitude of peak flows will affect the ice regime along the lower Churchill River. Although these effects are undefined at present it has been predicted that a permanent ice condition may result (Newbury 1971). Studies have been undertaken to determine the relationship between fresh water and ice formation at the port of Churchill.

2.4 LAKE WINNIPEG

Modified historic Lake Winnipeg levels have ranged between 709.67 and 717.16 feet in the period of record. Higher levels have occurred within the past century. Regulation will moderate level fluctuations between 711.10 and 716.50 feet. Regulated average levels will be .65 feet higher than historic. Table 31 shows the predicted changes in lake levels resulting from regulation. The greatest increases in minimum and average monthly levels will occur in fall. Historic maximum will generally be reduced in all months except November (Table 1 - page A50).

Regulation will not affect wind set-up and wave uprush. These two factors can each increase levels by as much as four feet at specific locations. The incidence of these conditions increases as the open water season progresses into fall. There is a 5% chance of having a set-up of one foot or more in June, while there is a 10% chance of the same set-up occurring in October. Maximum recorded June set-up is 2.67 feet and the October maximum is 3.78 feet. Wave uprush values are generally dependent on shoreline configuration.

Regulation will increase mean annual average levels in the Outlet Lakes area by two to three feet. Kiskitto Lake levels will be increased by an average of 3.6 feet.

Downstream of Jenpeg, Cross Lake will experience a decrease of .66 feet in average annual levels. However, mean minimums will be 1.3 feet lower than historic and mean maximums 1.4 feet higher. The annual fluctuation sequence will be reversed with level increases in fall to a winter peak and a spring drawdown to summer lows.

Clearing has been carried out in the Jenpeg reservoir which is presently being filled.

TABLE 1

DIFFERENCES IN MEAN MONTHLY LEVELS BETWEEN REGULATED AND UNREGULATED CONDITION*

LAKE WINNIPEG

Month	Minimum levels	Average levels	Maximum levels
January	+ 1.14	+ .84	- .32
February	+ .93	+ .67	- .24
March	+ .85	+ .55	- .40
April	+ .80	+ .26	- .47
May	+ .79	+ .22	- .32
June	+ .92	+ .28	- .50
July	+ 1.16	+ .36	- .76
August	+ 1.46	+ .58	- .65
September	+ 1.60	+ .87	- .47
October	+ 1.69	+ 1.09	- .55
November	+ 1.55	+ 1.17	+ .03
December	+ 1.33	+ 1.00	- .25
Annual	+ 1.43	+ .65	- .66

* Source - Manitoba Hydro sequence GIJ-A

APPENDIX 16

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Appendix	6	Wildlife Studies	
Appendix	7	Recreation and Archaeological Studies	
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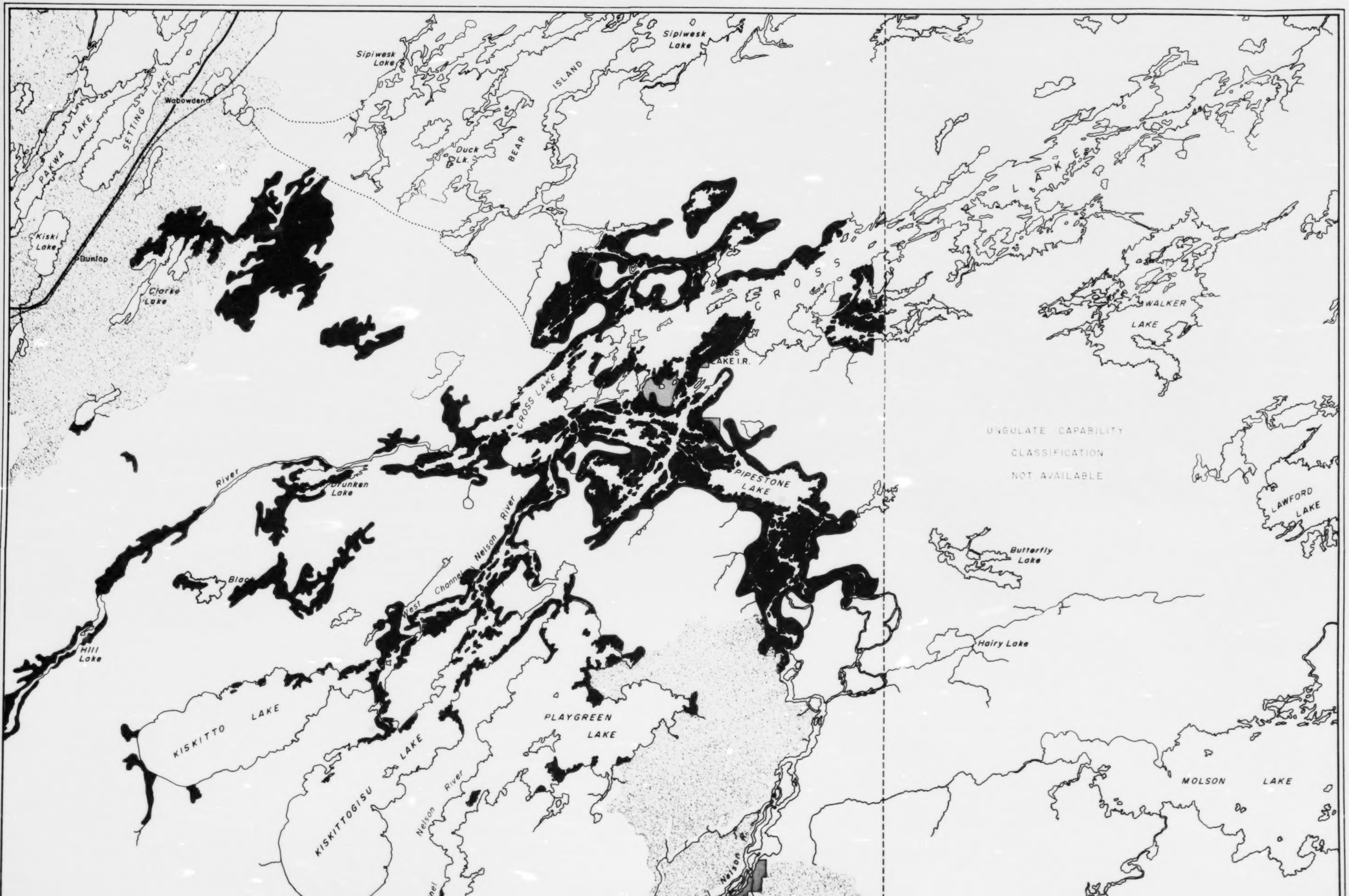
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Wabowden
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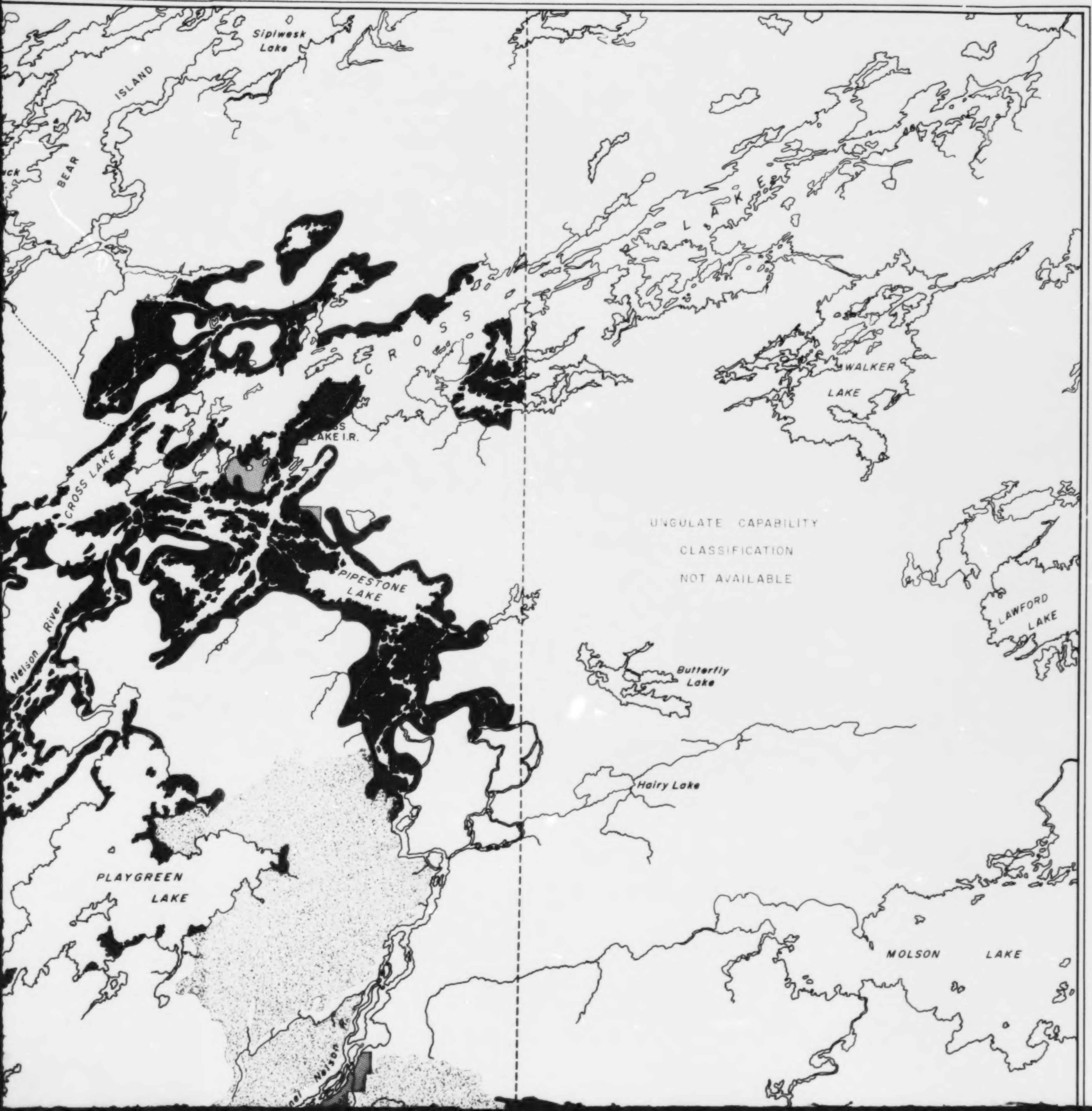
SETTING LAKE
Kiski Lake
Dunlop
Clarke Lake
L A K E S
C R O S S
CROSS LAKE I.R.
CROSS LAKE
WALKER LAKE
UNGULATE CAPABILITY
CLASSIFICATION
NOT AVAILABLE
River
Drunken Lake
PIPESTONE LAKE
LAWFORD LAKE
Butterfly Lake
Nelson River
West Channel
Black
Hill Lake
Hairy Lake
PLAYGREEN LAKE
KISKITTO LAKE
KISKITTOGISU LAKE
MOLSON LAKE
Nelson River
Nelson R.
Channel



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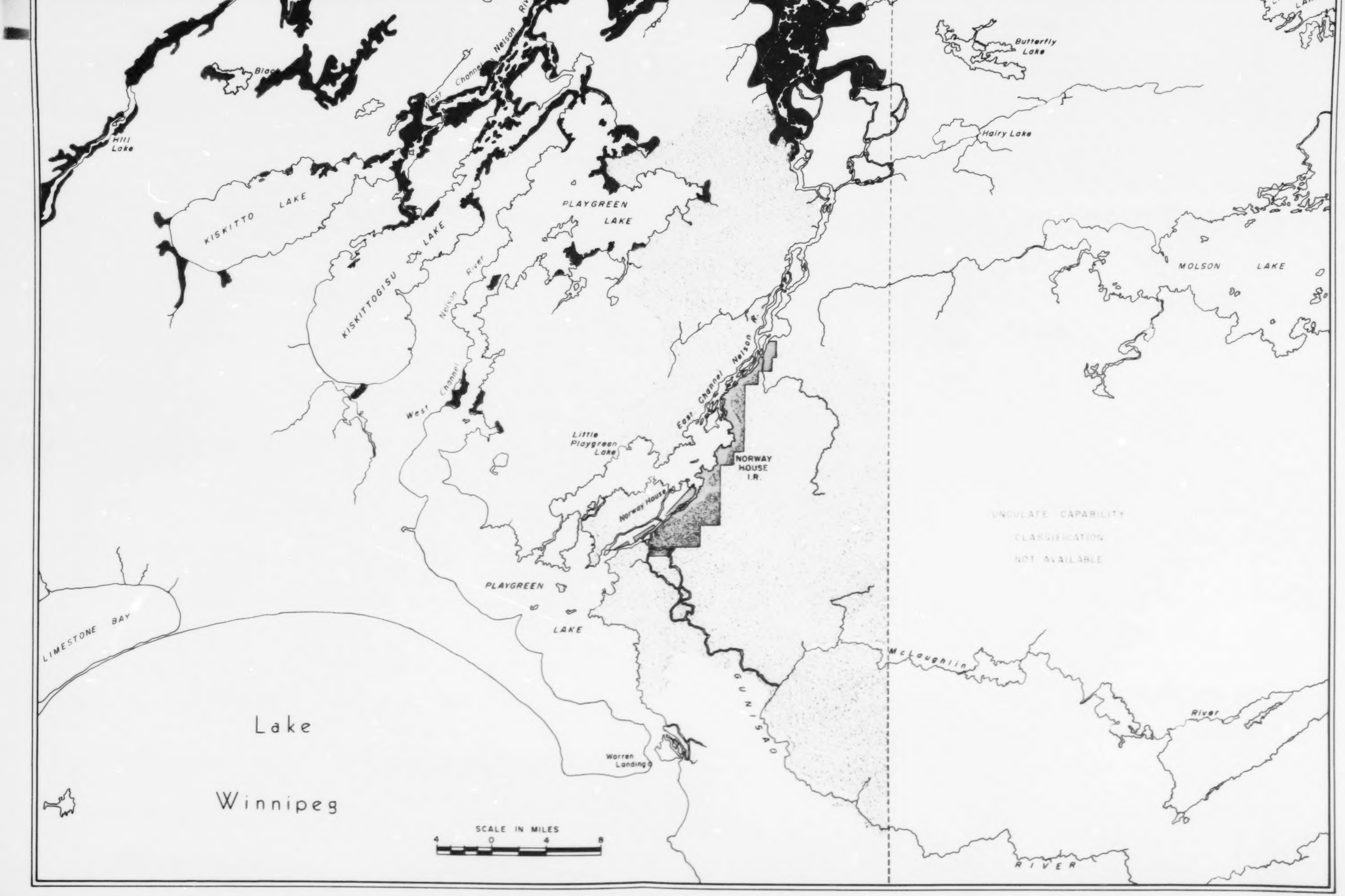
UNGULATE CAPABILITY
CLASSIFICATION
NOT AVAILABLE
PIPESTONE LAKE
Nelson River
LAWFORD LAKE
Butterfly Lake
Hairy Lake
PLAYGREEN LAKE
MOLSON LAKE
Nelson R.

LEGEND

■ Moose

▨ Caribou

Note: Class Two areas for moose or caribou may also contain classes 2 to 7 for caribou & moose respectively.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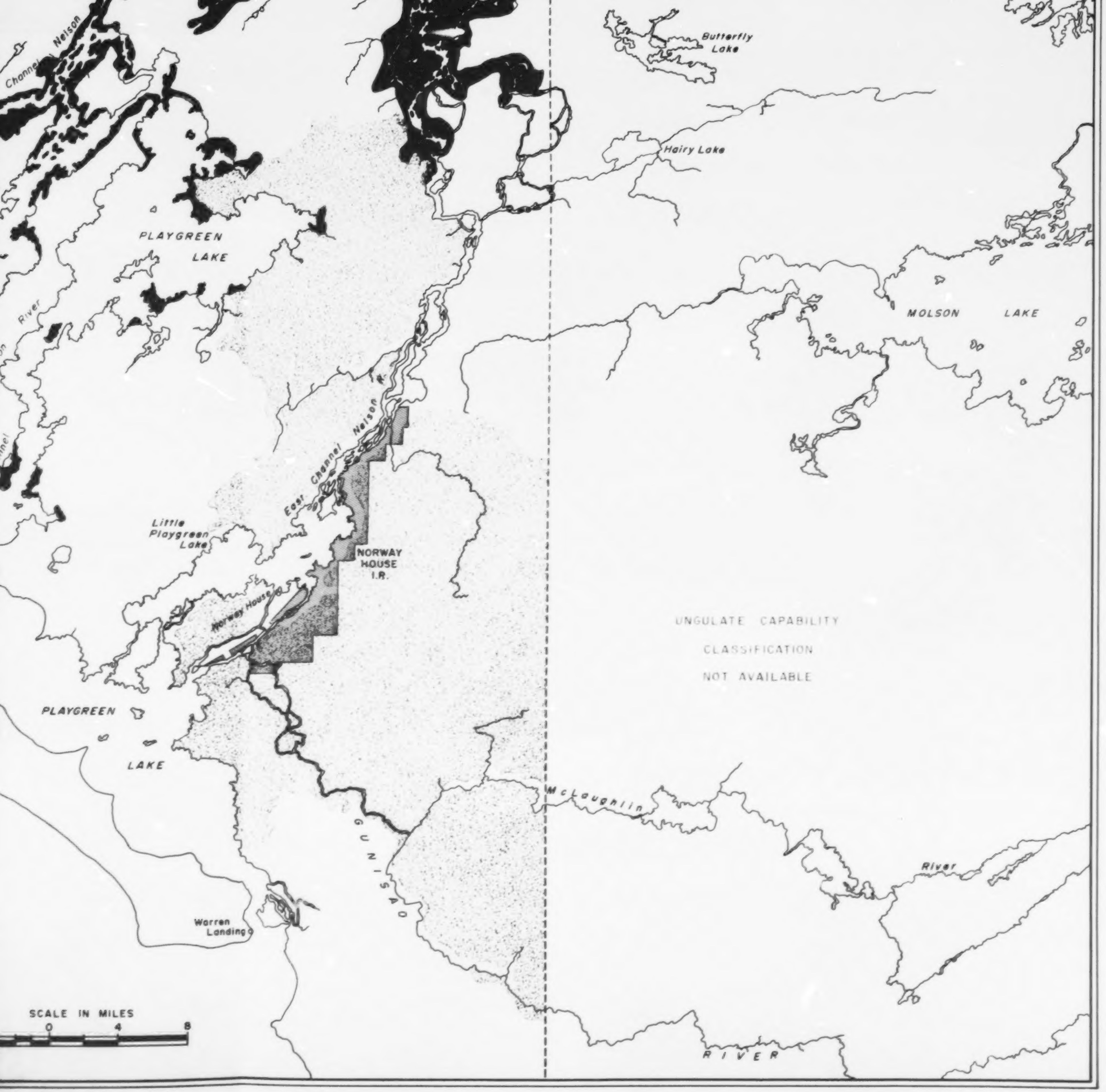
Nelson River
Butterfly Lake
Hairy Lake
KISKITTO LAKE
KISKITTOGISU LAKE
PLAYGREEN LAKE
Nelson River
West Channel
MOLSON LAKE
East Channel Nelson R.
Little Playgreen Lake
NORWAY HOUSE I.R.
Norway House
UNGULATE CAPABILITY
CLASSIFICATION
NOT AVAILABLE
PLAYGREEN
LAKE
LIMESTONE BAY
GUNISAO
McLaughlin
River
Lake
Winnipeg
Warren Landing
SCALE IN MILES
4
0
4
8
RIVER


Channel Nelson
Butterfly Lake
Hairy Lake
PLAYGREEN LAKE
River
MOLSON LAKE
East Channel Nelson
Little Playgreen Lake
NORWAY HOUSE I.R.
Norway House
UNGULATE CAPABILITY CLASSIFICATION NOT AVAILABLE
PLAYGREEN LAKE
McLaughlin River
GUNISAO RIVER
Warren Landing
SCALE IN MILES
0
4
8

■ Moose

▨ Caribou

Note: Class Two areas for moose or caribou may also contain classes 2 & 7 for caribou & moose respectively.

APPENDIX I

CLASS TWO CAPABILITY RATED AREAS FOR MOOSE AND WOODLAND CARIBOU

Outlet Lakes — Manitoba

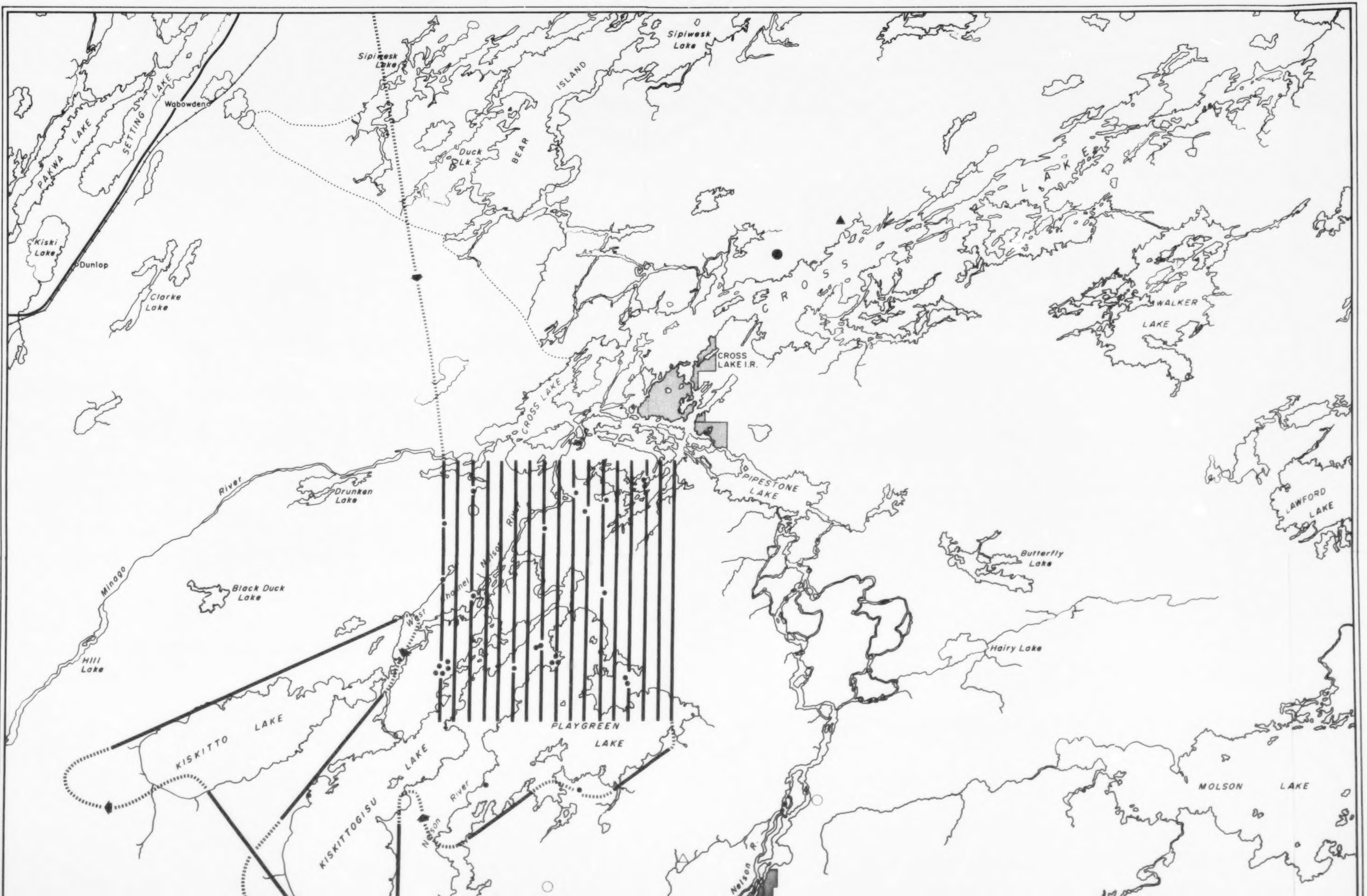
**LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS
STUDY BOARD**

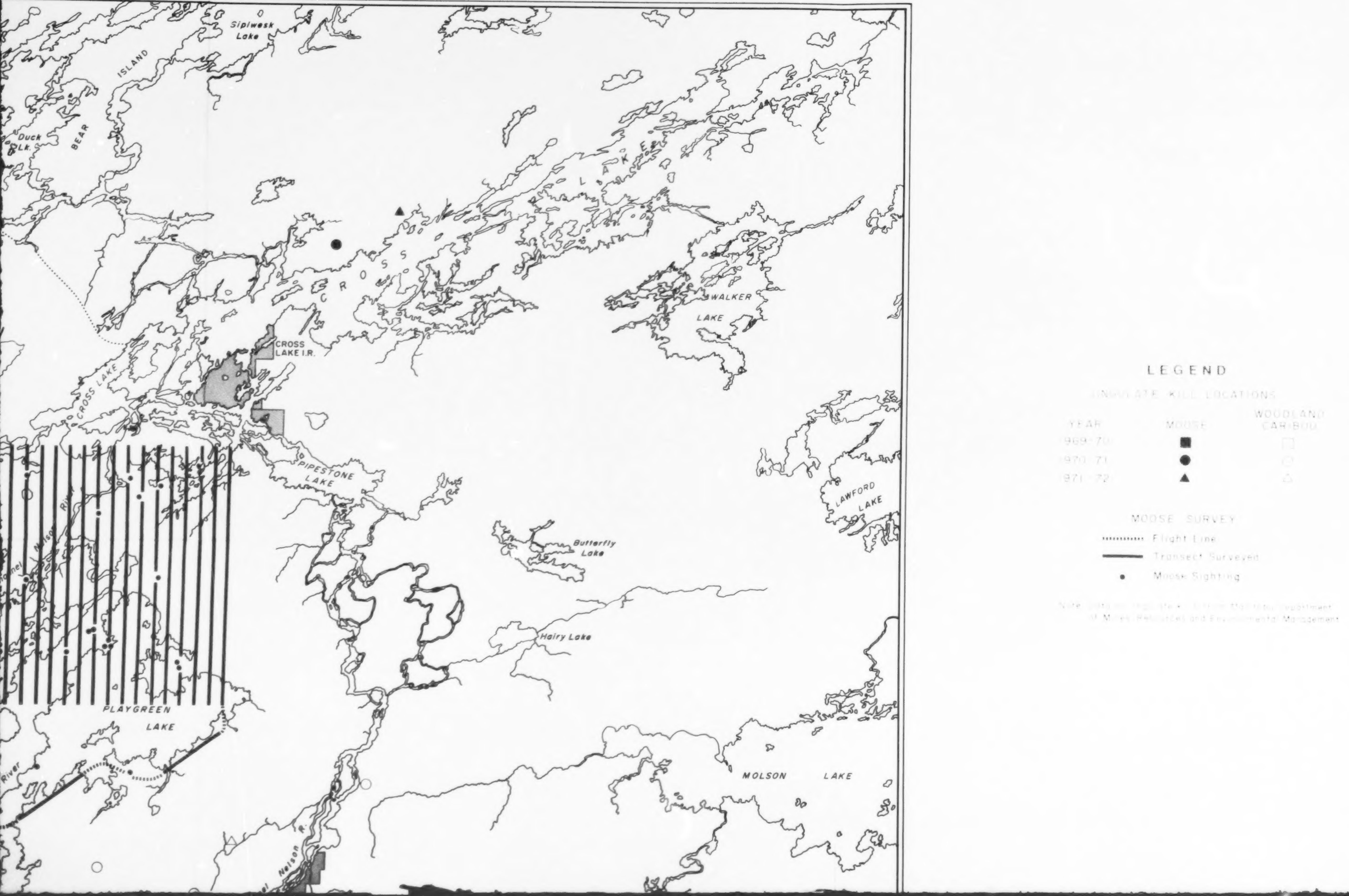
WINNIPEG MANITOBA

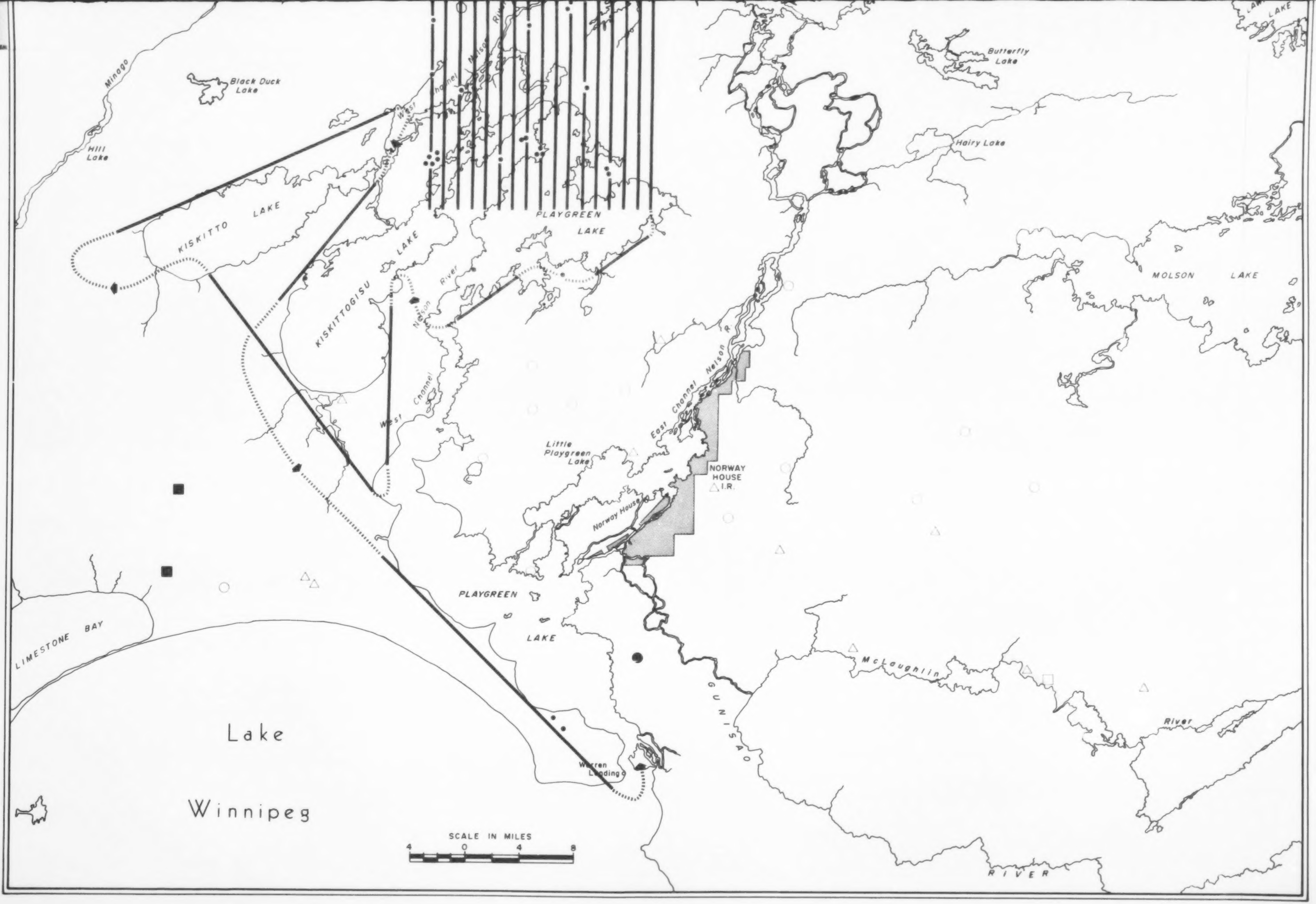
PROJECT NO. M 25

**F.F. SLANEY & COMPANY LIMITED
Resource Development & Environmental Management**

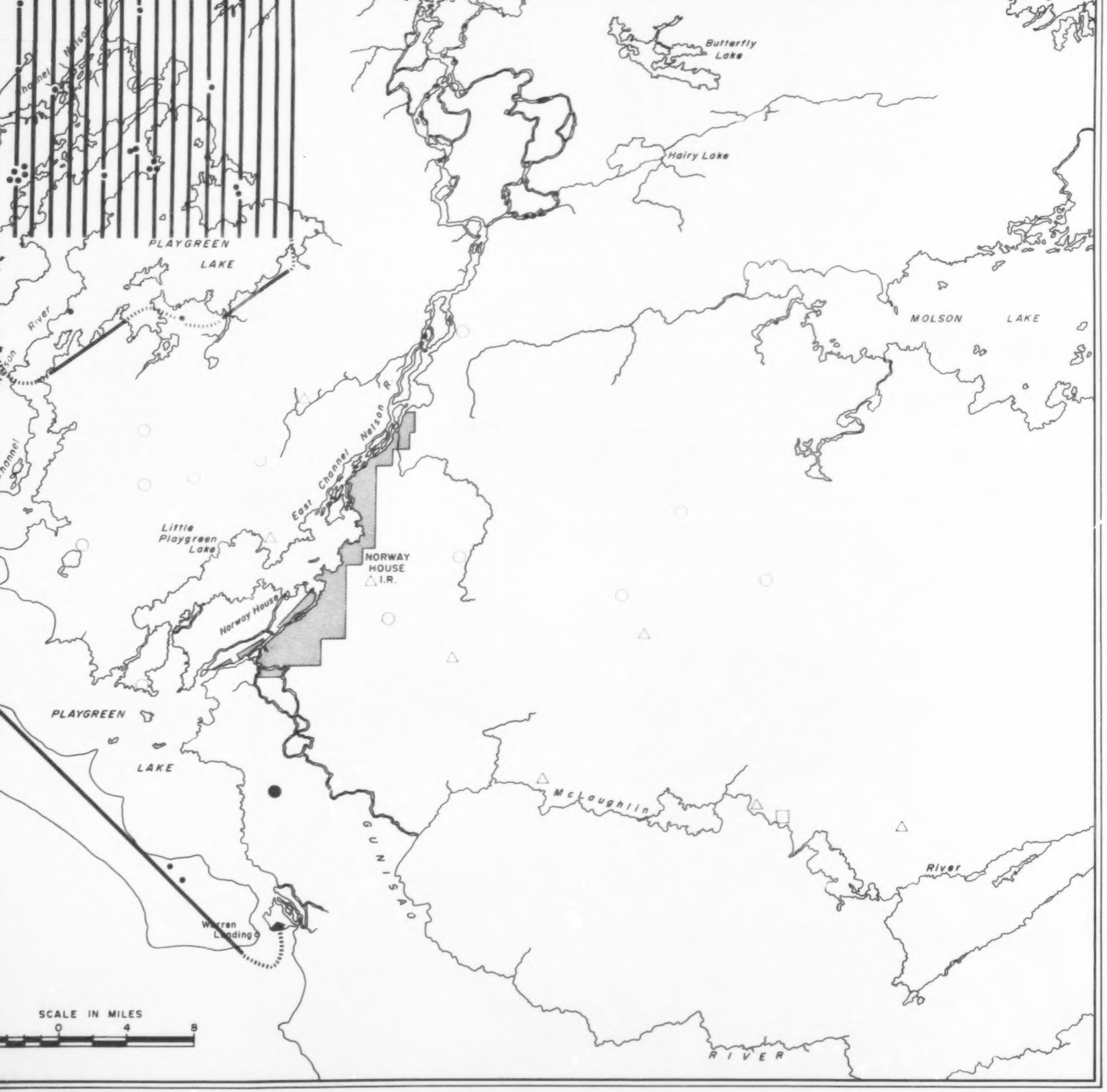
M25-MI/a


Sipiwesk Lake
Sipiwesk Lake
Wabowden
PAKWA LAKE
SETTING LAKE
Kiski Lake
Dunlop
Clarke Lake
Duck Lk.
BEAR ISLAND
CROSS LAKE
WALKER LAKE
CROSS LAKE I.R.
CROSS LAKE
PIPESTONE LAKE
River
Drunken Lake
Minago
Black Duck Lake
Hill Lake
West Channel
Nelson River
KISKITTO LAKE
KISKITTOGISU LAKE
PLAYGREEN LAKE
Nelson River
Butterfly Lake
LAWFORD LAKE
Hairy Lake
MOLSON LAKE
Nelson R.


Sipiwesk Lake
BEAR ISLAND
Duck Lk.
CROSS LAKE
CROSS LAKE I.R.
CROSS LAKE
WALKER LAKE
PIPESTONE LAKE
LAWFORD LAKE
Butterfly Lake
Nelson River
Hairy Lake
PLAYGREEN LAKE
River
MOLSON LAKE
Nelson R.
LEGEND
UNGULATE KILL LOCATIONS
YEAR
MOOSE
WOODLAND CARIBOU
1969-70 ■ □
1970-71 ● ○
1971-72 ▲ △
MOOSE SURVEY
Flight Line
Transect Surveyed
Moose Sighting
Note: Data on ungulate kill from Manitoba Department of Mines, Resources and Environmental Management



Minago
Black Duck Lake
Hill Lake
Butterfly Lake
Hairy Lake
LAKE
West Channel Nelson River
KISKITTO LAKE
KISKITTOGISU LAKE
PLAYGREEN LAKE
Nelson River
MOLSON LAKE
West Channel
East Channel Nelson R.
Little Playgreen Lake
NORWAY HOUSE I.R.
Norway House
PLAYGREEN LAKE
LIMESTONE BAY
Lake Winnipeg
Warren Landing
GUNISAO RIVER
McLaughlin River
SCALE IN MILES
4 0 4 8


Butterfly Lake
Hairy Lake
PLAYGREEN LAKE
MOLSON LAKE
River
Channel
Nelson
East Channel Nelson R.
Little Playgreen Lake
NORWAY HOUSE I.R.
Norway House
PLAYGREEN LAKE
McLaughlin River
GUNISAO RIVER
Warren Landing
SCALE IN MILES
0
4
8

MOOSE SURVEY

- Flight Line
- Transect Surveyed
- ● Moose Sighting

[illegible] Department
of Mines, Resources and Environmental Management

APPENDIX 2

UNGULATE KILL LOCATIONS (1969-72)
&
AERIAL MOOSE SURVEY (1972)

*LICENSED HUNTERS

Outlet Lakes — Manitoba

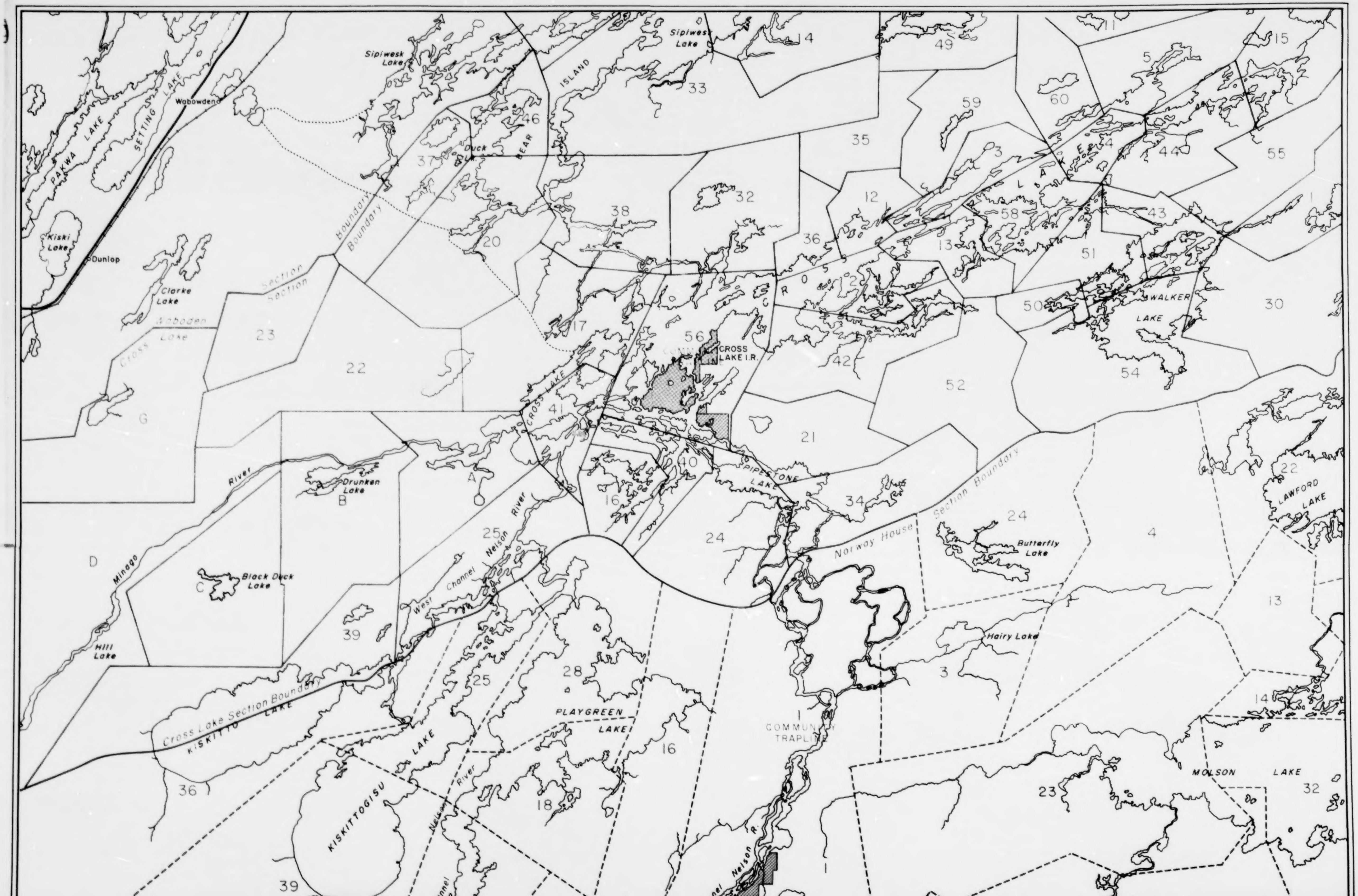
LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS
STUDY BOARD

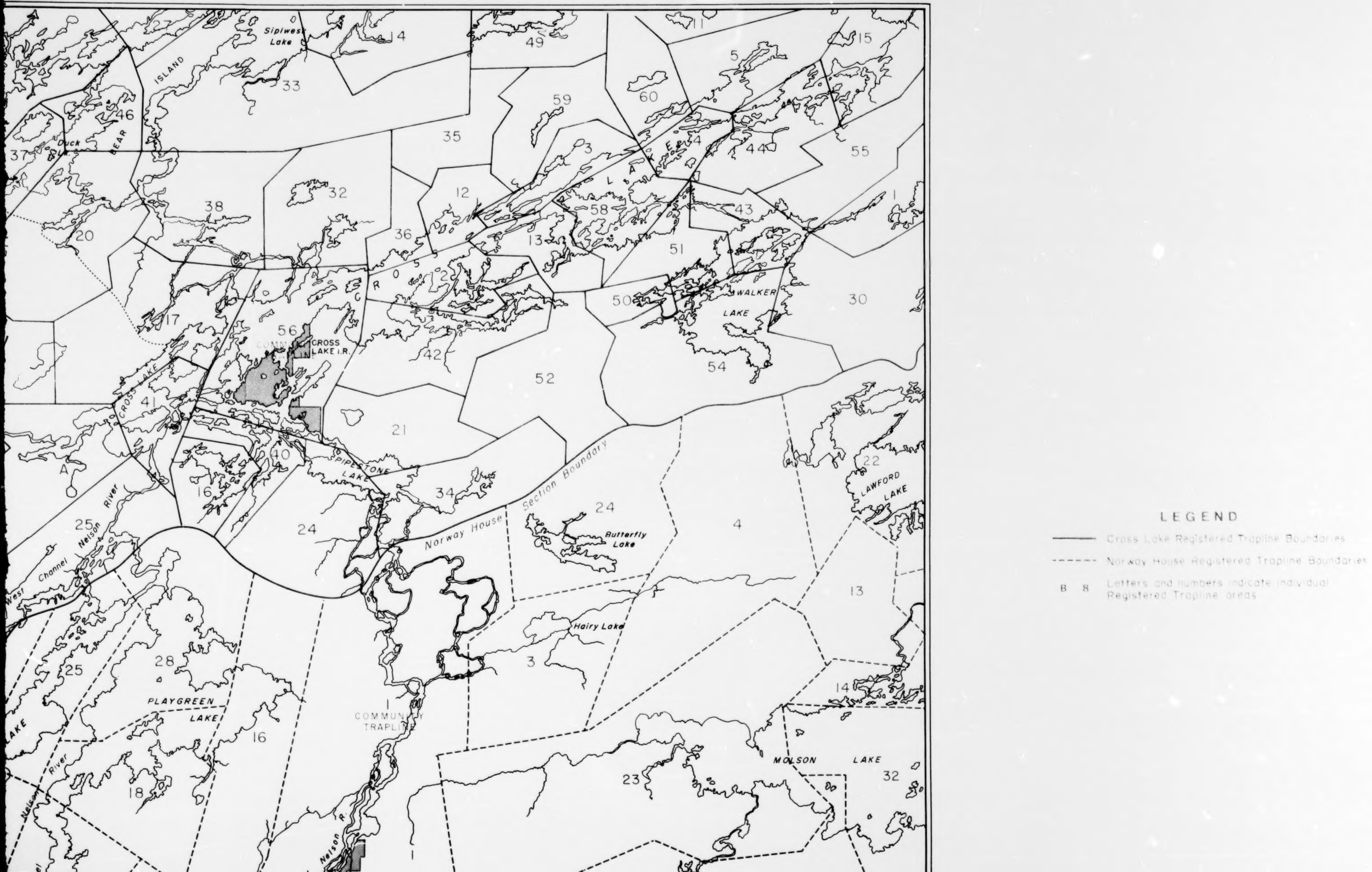
WINNIPEG MANITOBA

PROJECT NO. M 25

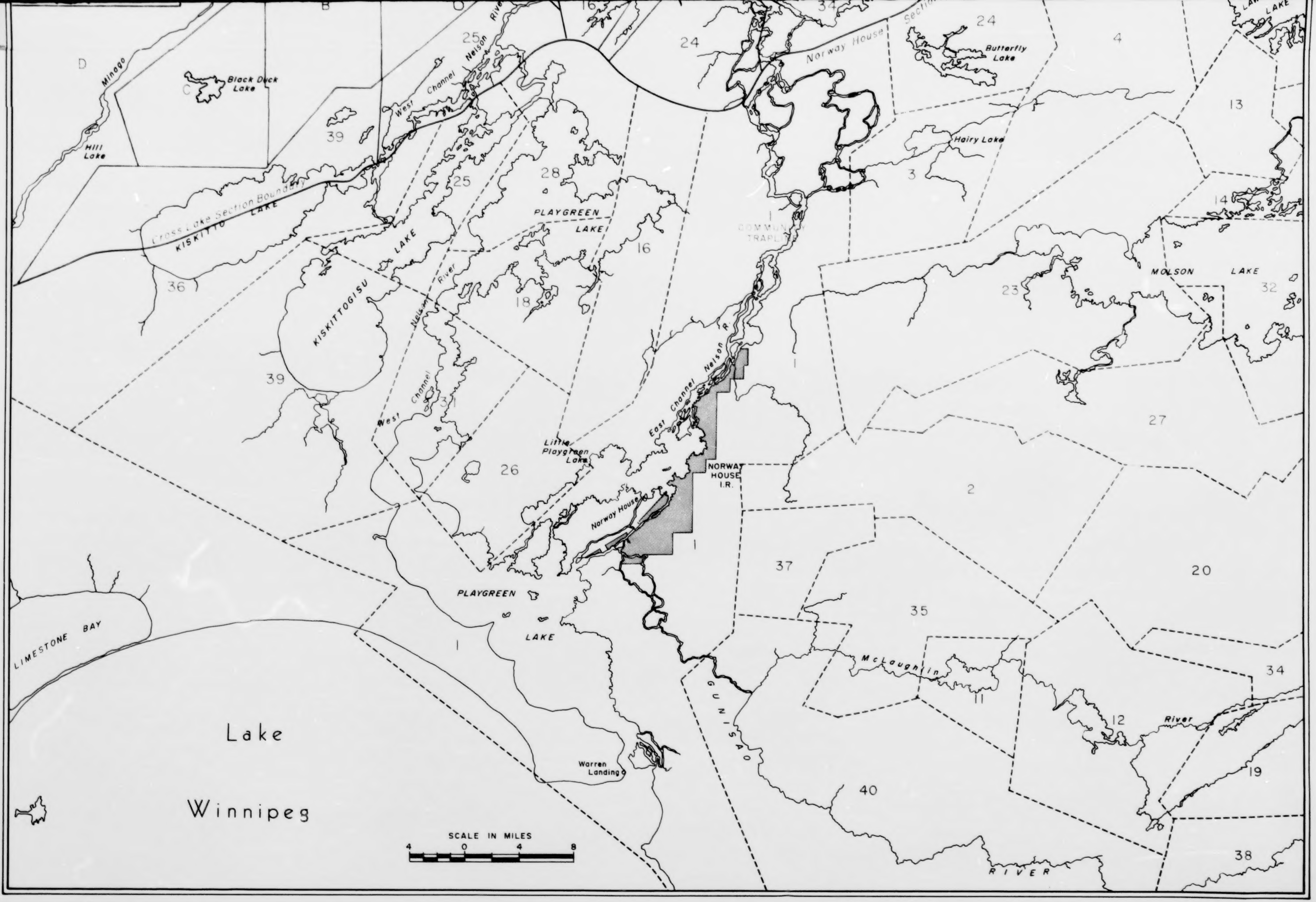
F.F. SLANEY & COMPANY LIMITED
Resource Development & Environmental Management

M25-M1/d

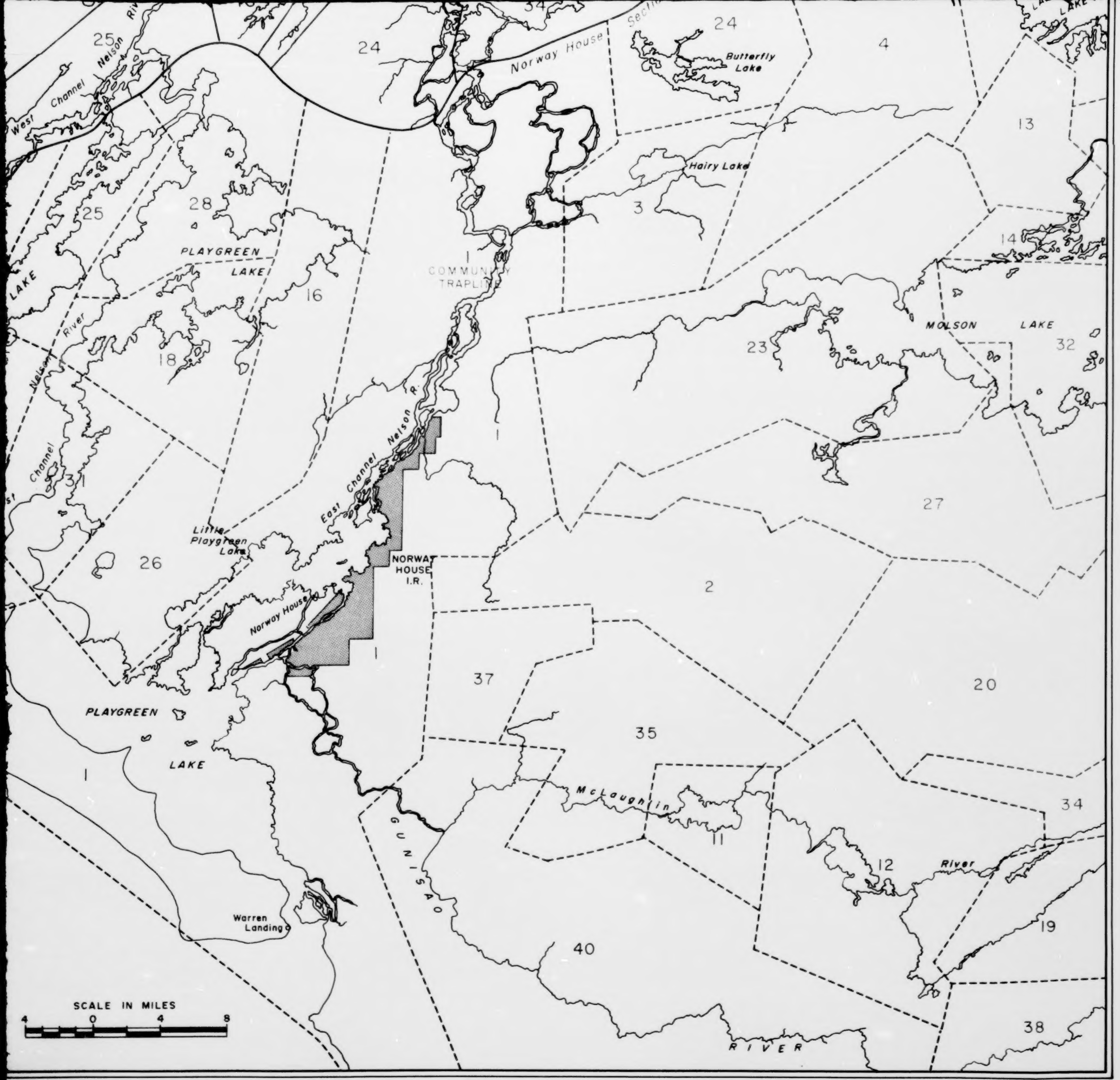

Sipiwesk Lake
Sipiwesk Lake
Wabowden
PAKWA LAKE
SETTING LAKE
Kiski Lake
Dunlop
Clarke Lake
Section Boundary
Section Boundary
Wabowden
Cross Lake
ISLAND
BEAR
Duck Lk.
CROSS LAKE I.R.
CROSS LAKE
C R O S S
L A K E
PIPESTONE LAKE
WALKER LAKE
LAWFORD LAKE
Butterfly Lake
Norway House Section Boundary
Hairy Lake
COMMUNITY TRAPLINE
MOLSON LAKE
PLAYGREEN LAKE
KISKITTOGISU LAKE
Cross Lake Section Boundary
KISKITTO LAKE
Minago River
Hill Lake
Black Duck Lake
Drunken Lake
West Channel Nelson River
Nelson River
Channel
Nelson R.
A
B
C
D
G
1
3
4
5
11
12
13
14
15
16
17
18
20
21
22
23
24
25
27
28
30
32
33
34
35
36
37
38
39
40
41
42
43
44
46
49
50
51
52
54
55
56
58
59
60



27
Sipiwesk Lake
14
49
11
15
5
ISLAND
33
46
60
59
35
Duck L.
BEAR
37
3
L A K E
4
44
55
32
12
38
1
58
43
36
13
20
51
C R O S S
2
30
50
WALKER
LAKE
17
56
COMMUNITY
CROSS LAKE I.R.
42
54
52
CROSS LAKE
41
21
A
40
PIPESTONE LAKE
Section Boundary
22
LAWFORD LAKE
16
34
24
24
Butterfly Lake
4
25
Nelson
River
Norway House
West Channel
13
Hairy Lake
28
3
25
14
PLAYGREEN
LAKE
16
1
COMMUNITY TRAPLINE
LAKE
MOLSON
LAKE
32
23
River
18
Nelson
Nelson R.
1
LEGEND
Cross Lake Registered Trapline Boundaries
Norway House Registered Trapline Boundaries
B 8
Letters and numbers indicate individual Registered Trapline areas
]



B
D
16
34
24
24
4
D
Minago
C
Black Duck Lake
25
Nelson River
West Channel
Norway House Section
Butterfly Lake
13
Hill Lake
39
Hairy Lake
28
25
3
14
Cross Lake Section Boundary
KISKITTO LAKE
PLAYGREEN LAKE
1
COMMUNITY TRAPLINE
16
36
KISKITTOGISU LAKE
West Nelson River
18
MOLSON LAKE
23
32
39
East Channel Nelson R.
1
West Channel
31
27
Little Playgreen Lake
26
NORWAY HOUSE I.R.
2
Norway House
1
37
20
PLAYGREEN LAKE
1
35
LIMESTONE BAY
34
McLaughlin
11
GUNISAO
12
River
Lake
Warren Landing
19
40
Winnipeg
SCALE IN MILES
4
0
4
8
38
RIVER


25
24
34
Norway House Section
24
Butterfly Lake
4
Lake
West Channel Nelson River
13
Hairy Lake
28
25
3
14
PLAYGREEN
LAKE
LAKE
1
COMMUNITY TRAPLINE
16
MOLSON LAKE
32
River
23
18
Nelson
Nelson R.
East Channel Nelson
1
Channel
27
31
East
Little Playgreen Lake
NORWAY HOUSE I.R.
26
2
Norway House
1
37
20
PLAYGREEN
35
LAKE
1
34
McLaughlin
11
12
River
19
GUNISAO
Warren Landing
40
38
RIVER
SCALE IN MILES
4 0 4 8

LEGEND

——— Cross Lake Registered Trapline Boundaries

- - - - - Norway House Registered Trapline Boundaries

B 8 Letters and numbers indicate individual Registered Trapline areas

APPENDIX 3

LOCATION OF REGISTERED TRAPLINE AREAS

Outlet Lakes – Manitoba

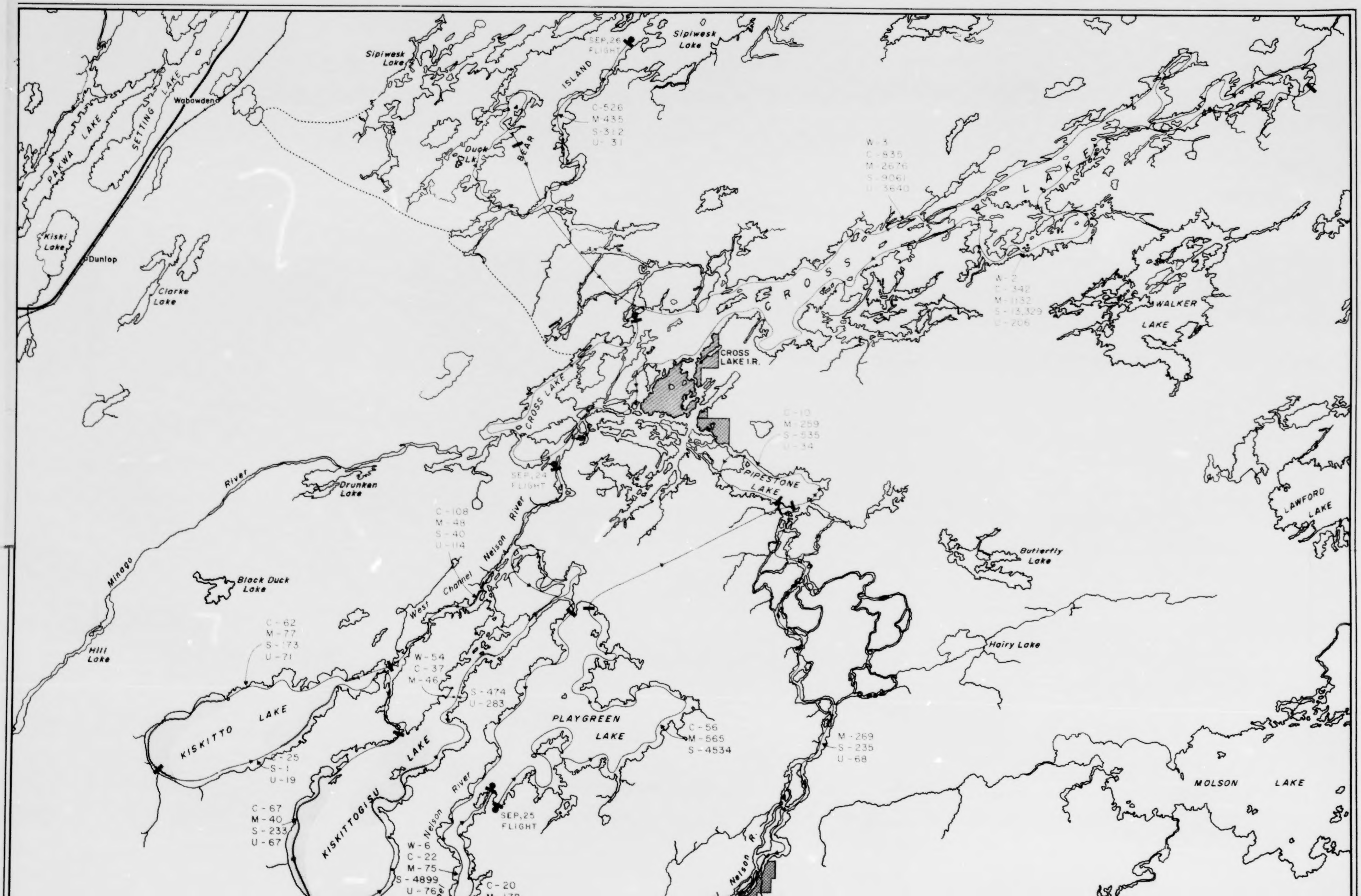
LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS STUDY BOARD

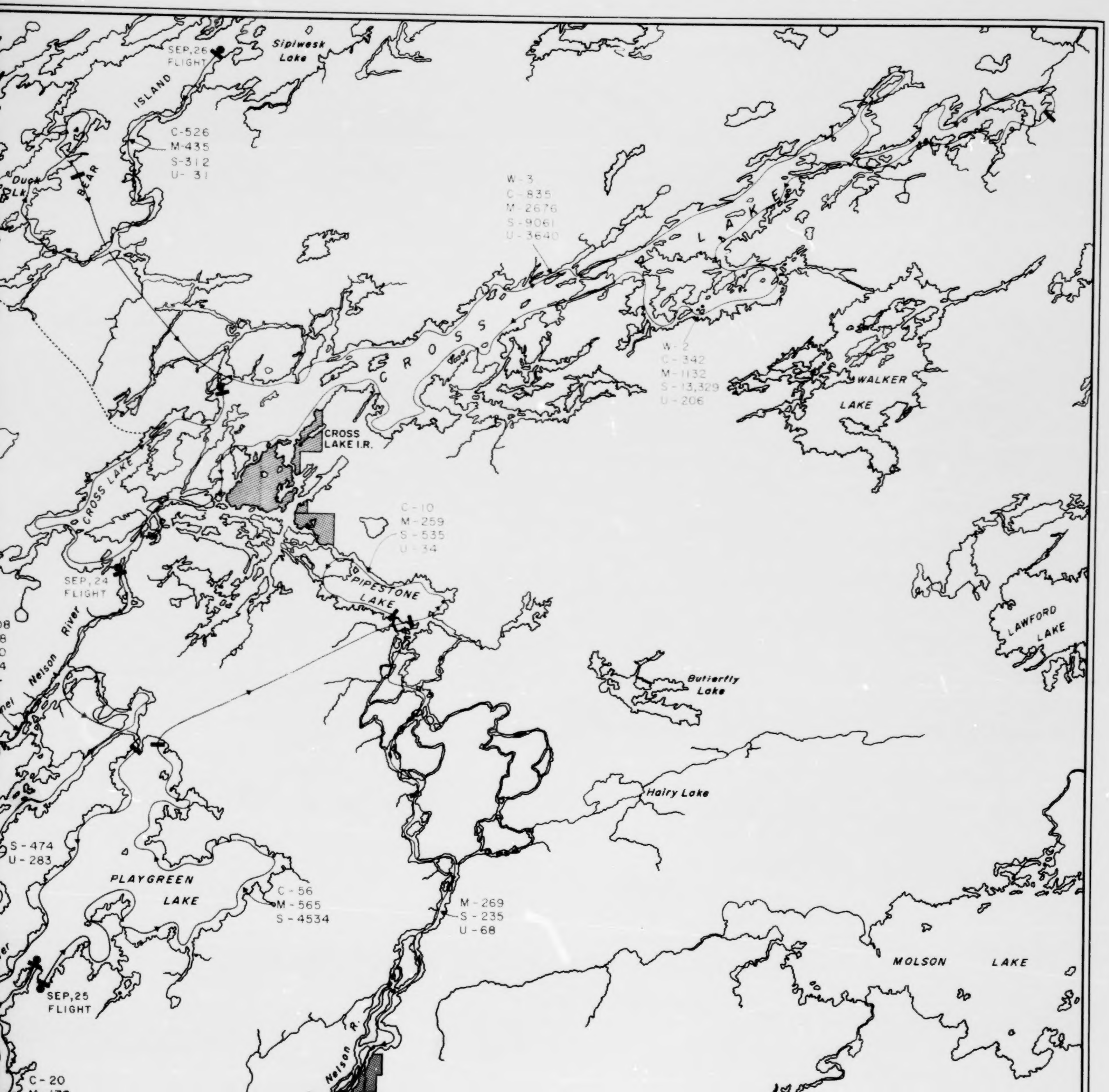
WINNIPEG MANITOBA

PROJECT NO. M 25

F.F. SLANEY & COMPANY LIMITED
Resource Development & Environmental Management

M25-M1/c


Sipiwesk Lake
SEP,26 FLIGHT
Sipiwesk Lake
ISLAND
Wabowden
SETTING LAKE
PAKWA LAKE
Duck Lk.
BEAR
C-526
M-435
S-312
U-31
Kiski Lake
Dunlop
Clarke Lake
W-3
C-835
M-2676
S-9061
U-3640
LAKE
CROSS
W-2
C-342
M-1132
S-13,329
U-206
WALKER LAKE
CROSS LAKE I.R.
CROSS LAKE
C-10
M-259
S-535
U-34
PIPESTONE LAKE
SEP,24 FLIGHT
River
Drunken Lake
C-108
M-48
S-40
U-114
Nelson River
West Channel
LAWFORD LAKE
Butterfly Lake
Minago
Black Duck Lake
Hill Lake
C-62
M-77
S-173
U-71
W-54
C-37
M-46
S-474
U-283
Hairy Lake
KISKITTO LAKE
C-25
S-1
U-19
PLAYGREEN LAKE
C-56
M-565
S-4534
M-269
S-235
U-68
MOLSON LAKE
KISKITTOGISU LAKE
C-67
M-40
S-233
U-67
Nelson River
SEP,25 FLIGHT
W-6
C-22
M-75
S-4899
U-76
C-20
Nelson R.

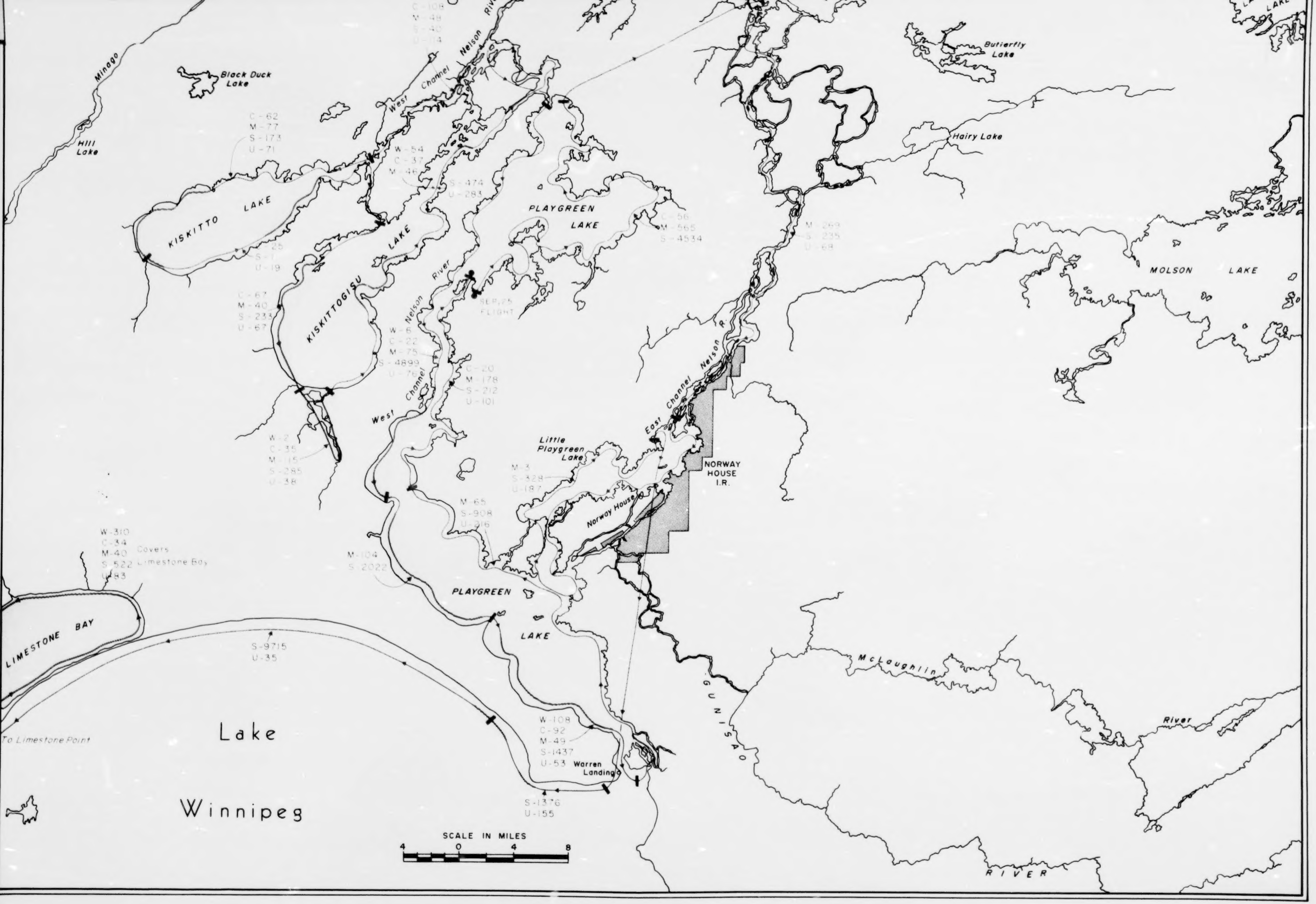

Sipiwesk Lake
SEP,26 FLIGHT
ISLAND
C-526
M-435
S-312
U- 31
Duck Lk
BEAR
W-3
C-835
M-2676
S-9061
U-3640
CROSS LAKE
W-2
C-342
M-1132
S-13,329
U-206
WALKER LAKE
CROSS LAKE I.R.
CROSS LAKE
C-10
M-259
S-535
U-34
SEP,24 FLIGHT
PIPESTONE LAKE
Nelson River
LAWFORD LAKE
Butterfly Lake
Hairy Lake
S-474
U-283
PLAYGREEN LAKE
C-56
M-565
S-4534
M-269
S-235
U-68
MOLSON LAKE
SEP,25 FLIGHT
Nelson R.
C-20

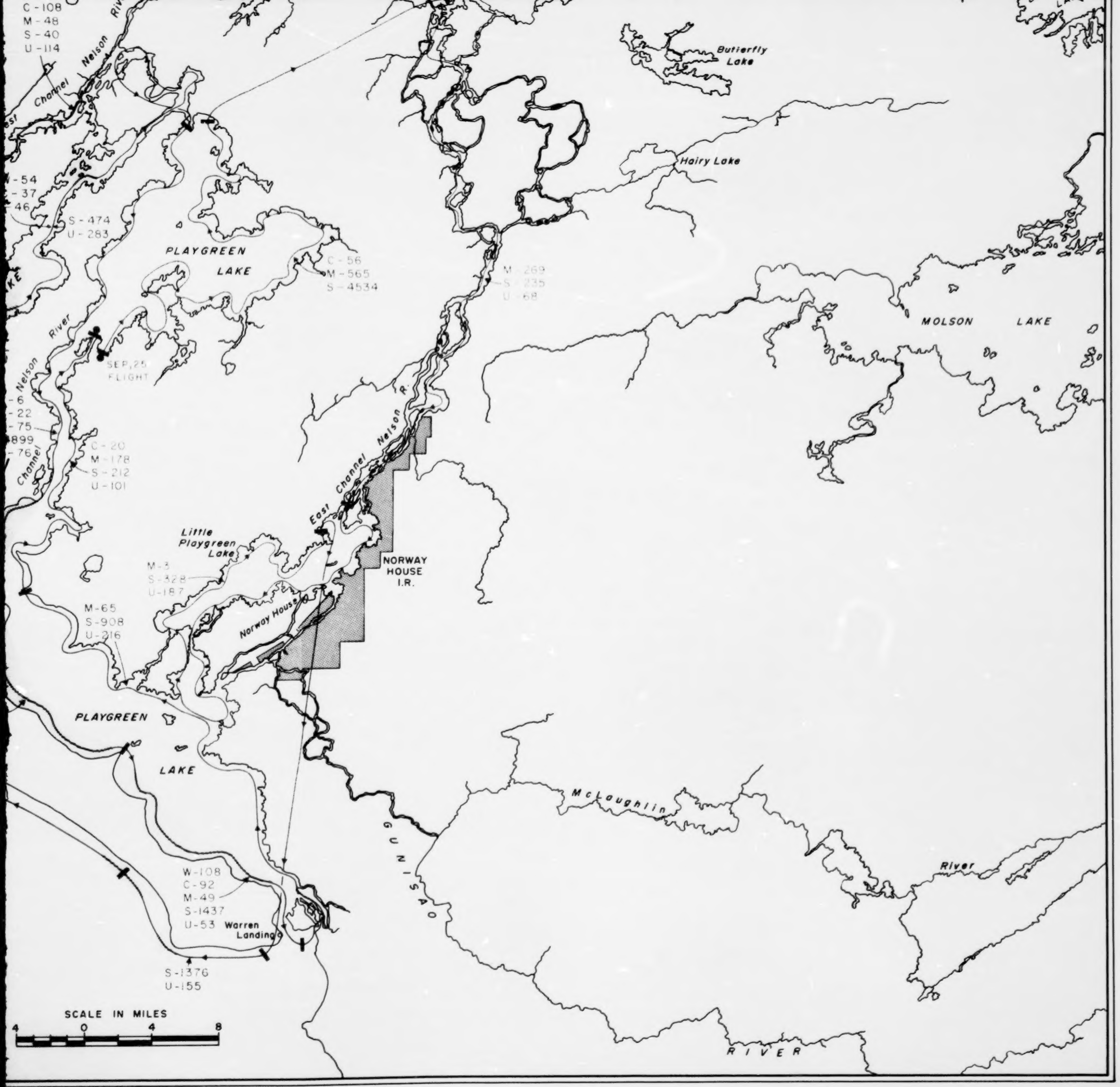
LEGEND

Census Unit
Flight Line
W Whistling Swans
C Canada Geese
M Mallards, other surface feeding ducks.
S Scaup, other diving ducks.
U Unidentified ducks.

▨ Canada Land Inventory Class 3 Migration Stops

Note: Class 3 water areas are important waterfowl migration stops according to the Canada Land Inventory capability rating system.


C-108
M-48
S-40
U-114
West Channel Nelson River
Minago
Black Duck Lake
Hill Lake
C-62
M-77
S-173
U-71
W-54
C-37
M-46
S-474
U-283
KISKITTO LAKE
-25
S-1
U-19
PLAYGREEN LAKE
C-56
M-565
S-4534
Butterfly Lake
Hairy Lake
M-269
S-235
U-68
MOLSON LAKE
KISKITTOGISU LAKE
C-67
M-40
S-233
U-67
Nelson River
SEP. 25 FLIGHT
W-6
C-22
M-75
S-4899
U-76
C-20
M-178
S-212
U-101
West Channel
East Channel Nelson R.
W-2
C-35
M-115
S-285
U-38
Little Playgreen Lake
M-3
S-328
U-187
NORWAY HOUSE I.R.
M-65
S-908
U-216
Norway House
W-310
C-34
M-40
S-522
U-83
Covers Limestone Bay
M-104
S-2022
PLAYGREEN LAKE
LIMESTONE BAY
S-9715
U-35
GUNISAO
McLaughlin River
To Limestone Point
Lake Winnipeg
W-108
C-92
M-49
S-1437
U-53
Warren Landing
S-1376
U-155
SCALE IN MILES
4 0 4 8
RIVER


C-108
M-48
S-40
U-114
Nelson
River
East Channel
Butterfly Lake
Hairy Lake
S-474
U-283
PLAYGREEN LAKE
C-56
M-565
S-4534
M-269
S-235
U-68
MOLSON LAKE
River
SEP. 25 FLIGHT
Nelson
Channel
C-20
M-178
S-212
U-101
East Channel Nelson R.
Little Playgreen Lake
M-3
S-328
U-187
NORWAY HOUSE I.R.
M-65
S-908
U-216
Norway House
PLAYGREEN LAKE
McLaughlin
River
GUNISAO
W-108
C-92
M-49
S-1437
U-53
Warren Landing
S-1376
U-155
SCALE IN MILES
4
0
4
8
RIVER

Census Unit
Flight Line
W Whistling Swans
C Canada Geese
M Mallards, other surface feeding ducks
S Scaup, other diving ducks.
U Unidentified ducks

Canada Land Inventory Class 3 Migration Stops

Note: Class 3 water areas are important waterfowl migration stops according to the Canada Land Inventory capability rating system.

APPENDIX 4

AERIAL SURVEY OF WATERFOWL STAGING AREAS

INCLUDING CANADA LAND INVENTORY
CLASS 3 MIGRATION STOPS

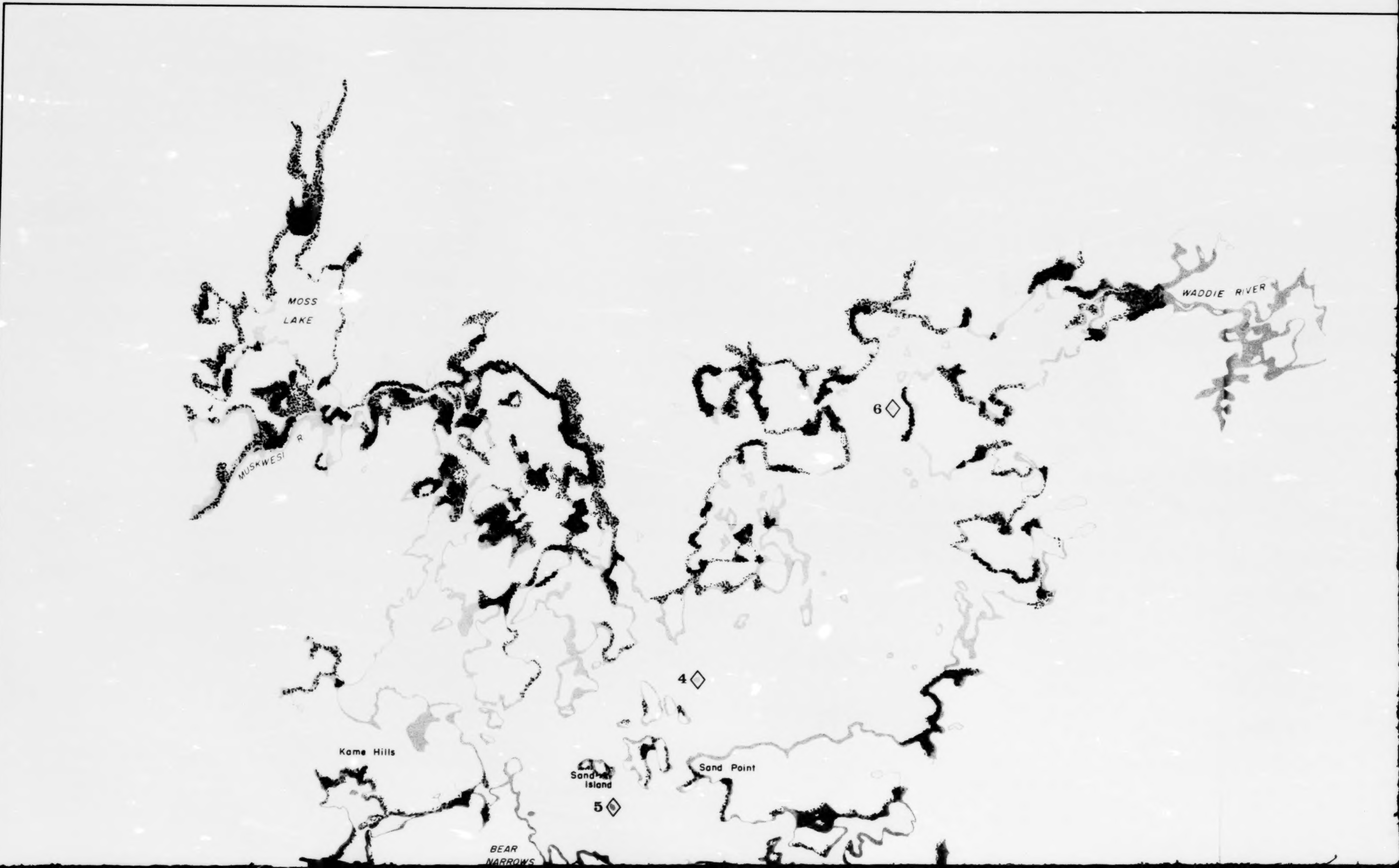
Outlet Lakes — Manitoba

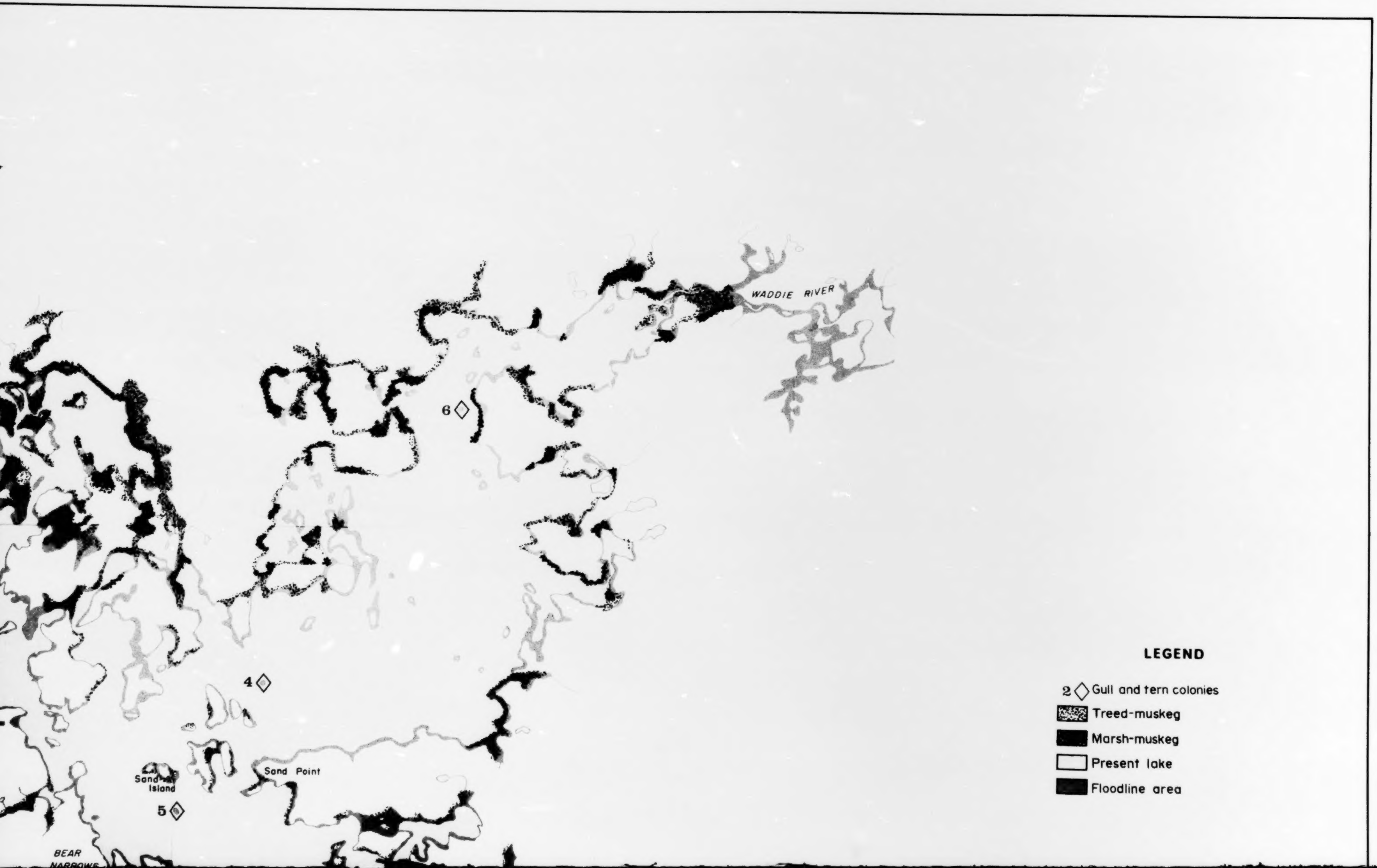
LAKE WINNIPEG, CHURCHILL AND NELSON RIVERS
STUDY BOARD

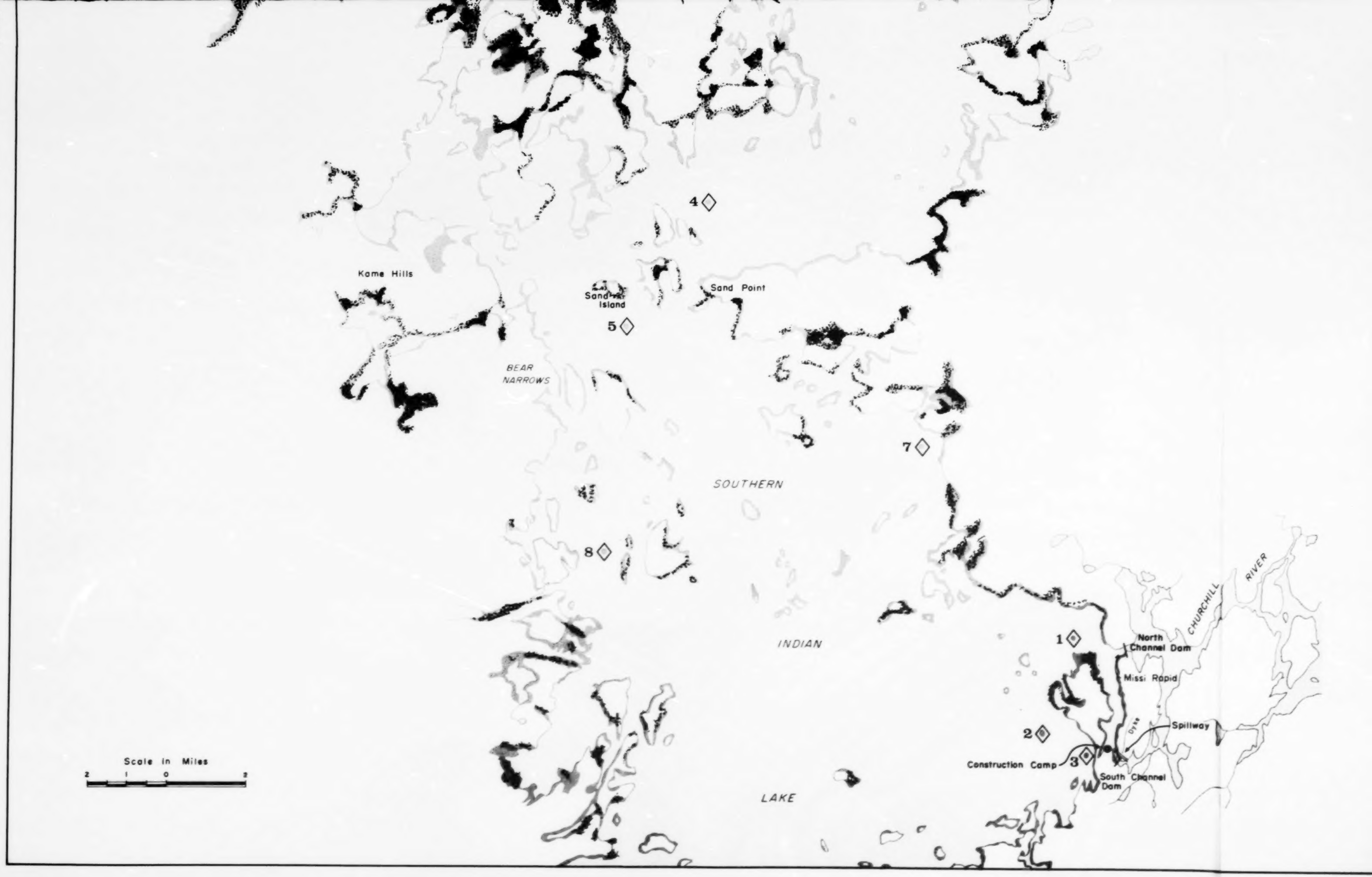
WINNIPEG MANITOBA

PROJECT NO. M 25

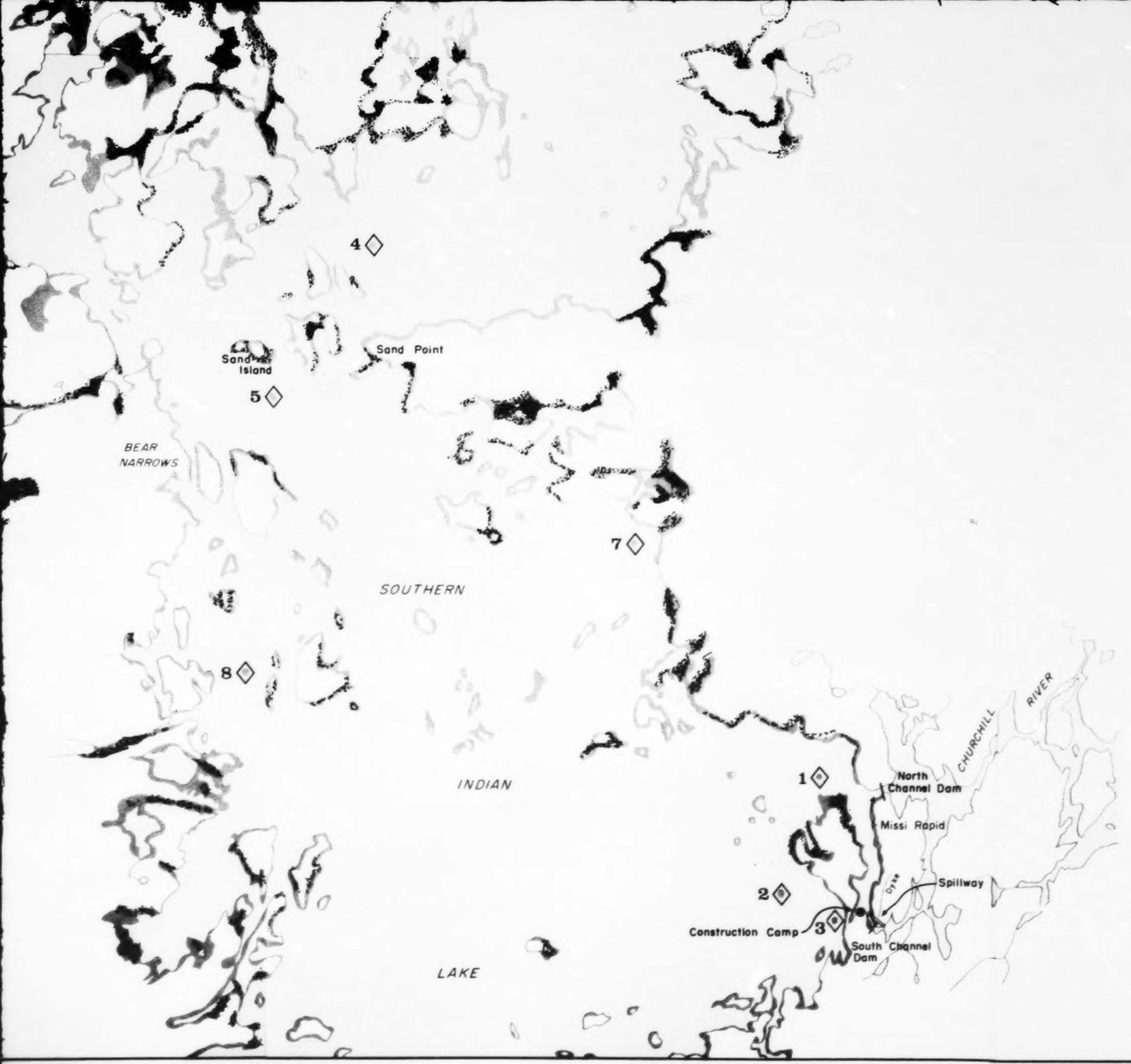
F.F. SLANEY & COMPANY LIMITED
Resource Development & Environmental Management


MOSS LAKE
MUSKWESI R
WADDIE RIVER
6
4
Kame Hills
Sand Island
Sand Point
5
BEAR NARROWS


WADDIE RIVER
6
4
Sand Point
Sand Island
5
BEAR NARROWS
LEGEND
2 ◇ Gull and tern colonies
▨ Treed-muskeg
■ Marsh-muskeg
☐ Present lake
■ Floodline area



4
Kame Hills
Sand Island
Sand Point
5
BEAR NARROWS
7
SOUTHERN
8
CHURCHILL RIVER
1
North Channel Dam
INDIAN
Missi Rapid
Dyke
Spillway
2
Scale in Miles
2 1 0 2
Construction Camp
3
South Channel Dam
LAKE


4
Sand Island
Sand Point
5
BEAR NARROWS
7
SOUTHERN
8
CHURCHILL RIVER
1
North Channel Dam
INDIAN
Missi Rapid
Dyke
Spillway
2
Construction Camp
3
South Channel Dam
LAKE

LEGEND

2 ◇ Gull and tern colonies

▨ Treed-muskeg

■ Marsh-muskeg

□ Present lake

▒ Floodline area

APPENDIX 5

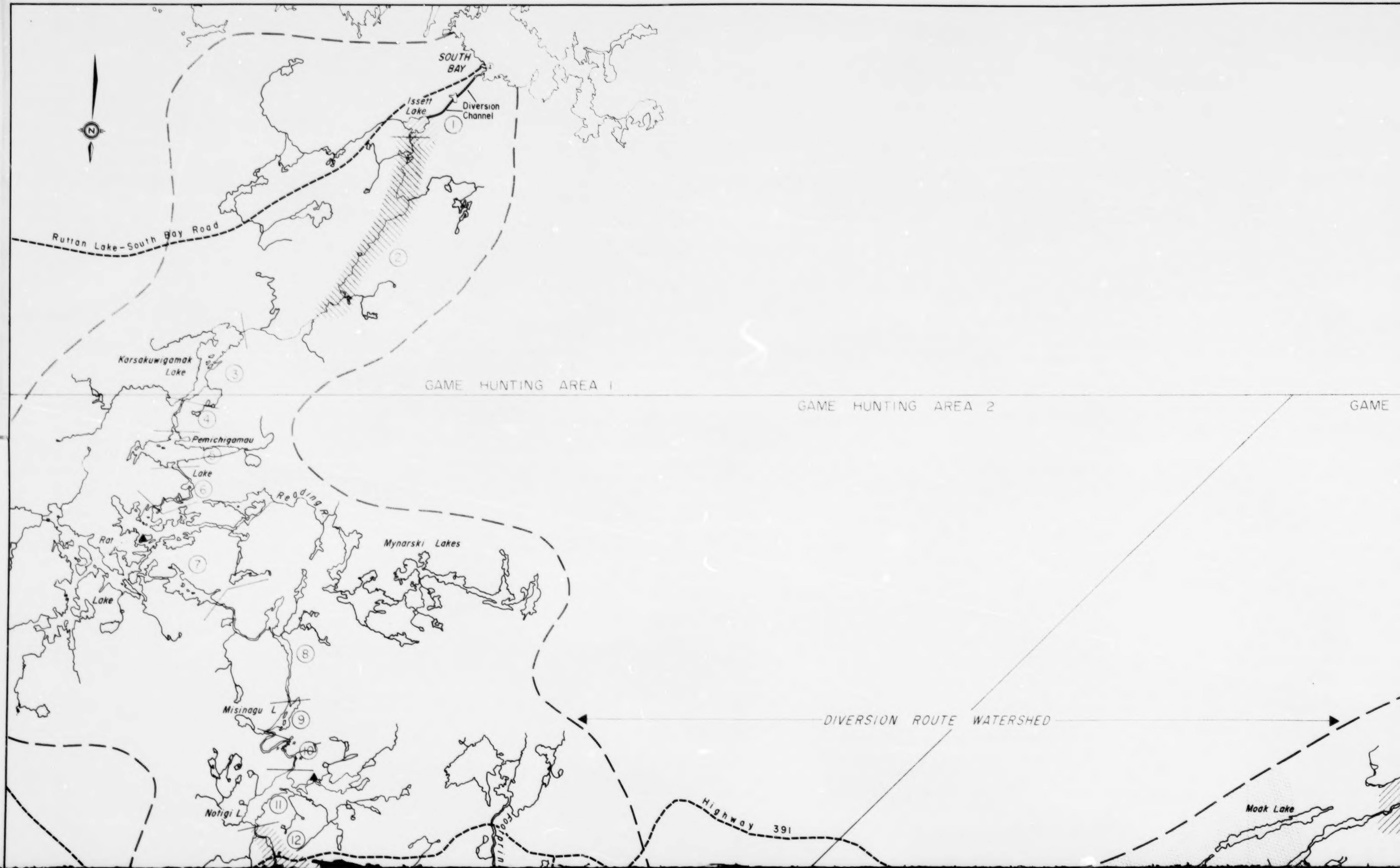
MARSH-MUSKEG, TREED MUSKEG GULL AND TERN COLONIES 1973

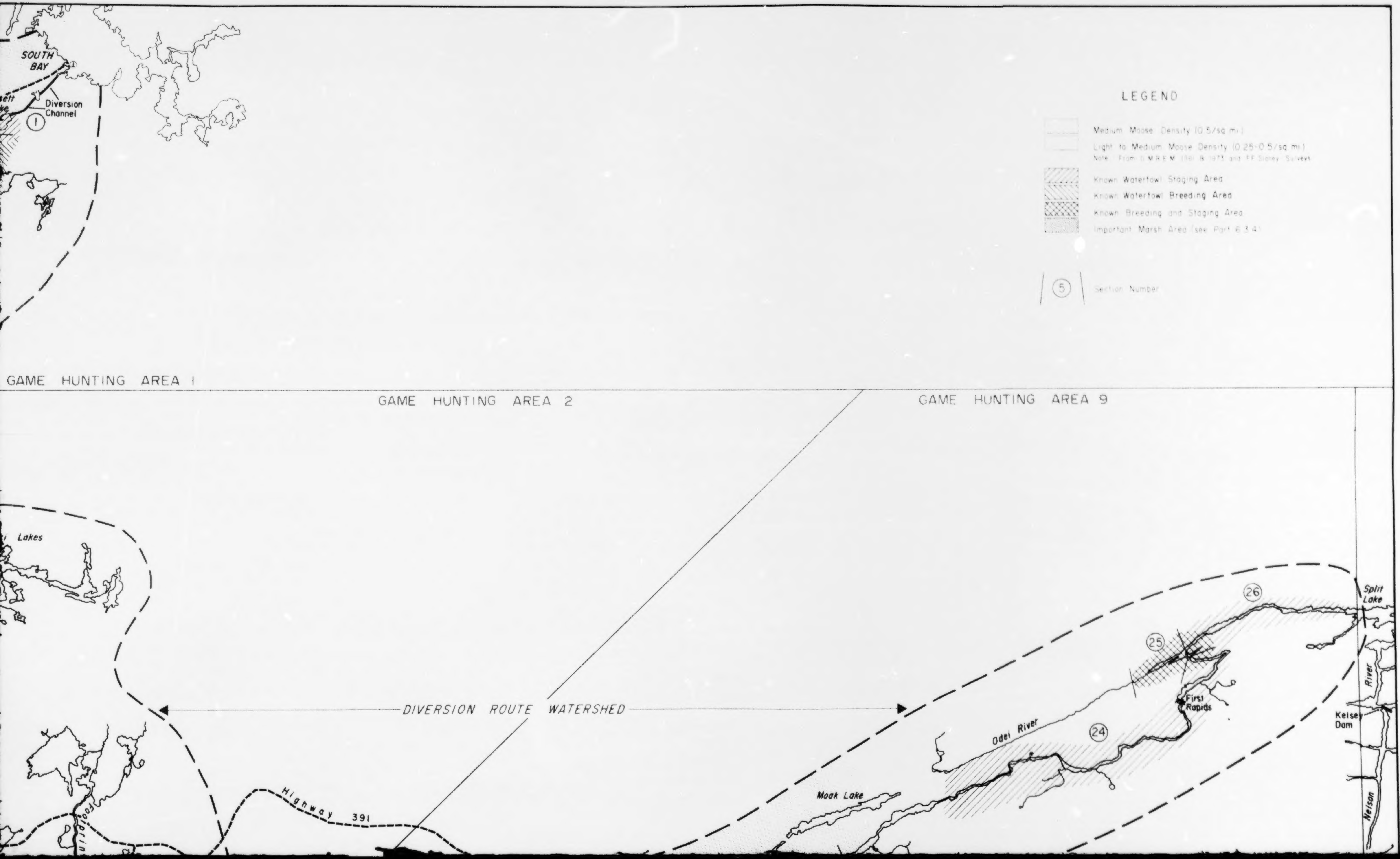
SOUTHERN INDIAN LAKE - MANITOBA

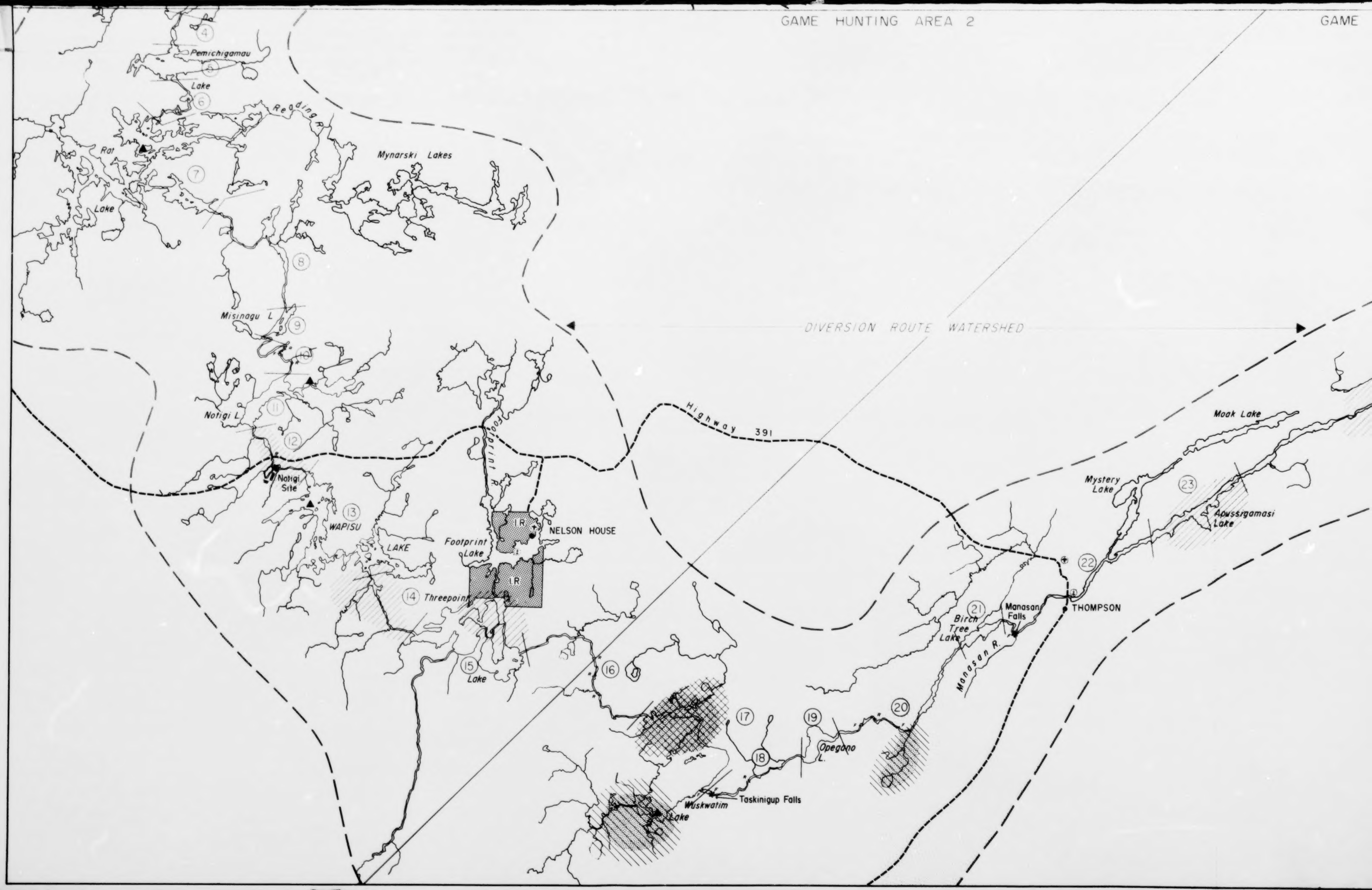
LAKE WINNIPEG,
CHURCHILL AND NELSON RIVERS
STUDY BOARD
WINNIPEG MANITOBA

PROJECT NO. M 25

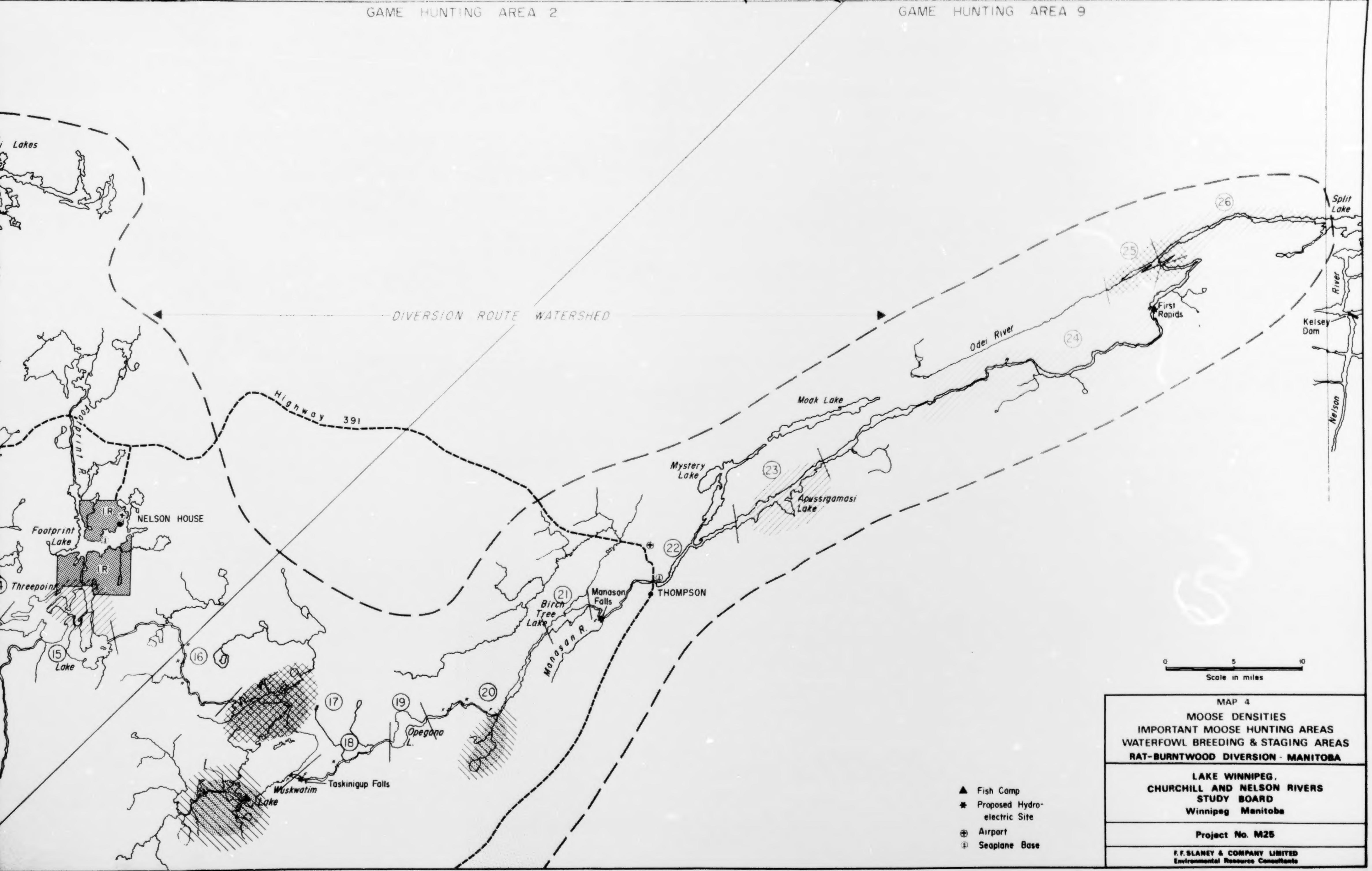
F. F. SLANEY & COMPANY LIMITED
Environmental Resource Consultants


SOUTH BAY
Issett Lake
Diversion Channel
1
2
Ruttan Lake-South Bay Road
Karsakuwigamak Lake
3
GAME HUNTING AREA 1
GAME HUNTING AREA 2
GAME
4
Pemichigamau
5
Lake
6
Reading R.
Rat
Lake
7
Mynarski Lakes
8
Misinagu L.
9
10
Notigi L.
11
12
DIVERSION ROUTE WATERSHED
Highway 391
Footprin
Moak Lake


LEGEND
Medium Moose Density (0.5/sq mi)
Light to Medium Moose Density (0.25-0.5/sq mi)
Note: From D.M.R.E.M. 1961 & 1973 and F.F. Sigley Surveys
Known Waterfowl Staging Area
Known Waterfowl Breeding Area
Known Breeding and Staging Area
Important Marsh Area (see Part 6.3.4)
5
Section Number
SOUTH BAY
Diversion Channel
1
GAME HUNTING AREA 1
GAME HUNTING AREA 2
GAME HUNTING AREA 9
Lakes
DIVERSION ROUTE WATERSHED
Highway 391
26
25
24
Split Lake
First Rapids
Odei River
Moak Lake
Kelsey Dam
Nelson River



GAME HUNTING AREA 2
GAME
④
Pemichigamau
⑤
Lake
⑥
Reading R.
Rat
Lake
⑦
Mynarski Lakes
⑧
Misinagu L.
⑨
⑩
⑪
Notigi L.
⑫
Notigi Site
⑬
WAPISU
LAKE
⑭
Threepoint
⑮
Lake
Footprint R.
Footprint Lake
I.R.
I.R.
NELSON HOUSE
DIVERSION ROUTE WATERSHED
Highway 391
⑯
⑰
⑱
⑲
⑳
Wuskwatim Lake
Taskinigup Falls
Opegano L.
㉑
Birch Tree Lake
Manasan R.
Manasan Falls
THOMPSON
㉒
Mystery Lake
Moak Lake
㉓
Apussigamasi Lake


GAME HUNTING AREA 2
GAME HUNTING AREA 9
Lakes
DIVERSION ROUTE WATERSHED
Highway 391
Footprint R.
NELSON HOUSE
I.R.
I.R.
Footprint Lake
Threepoint
15
Lake
16
17
18
19
20
21
22
23
24
25
26
Wuskwatim
Lake
Taskinigup Falls
Opegano L.
Birch Tree Lake
Manasan Falls
Manasan R.
THOMPSON
Mystery Lake
Moak Lake
Apussigamasi Lake
Odei River
First Rapids
Split Lake
Kelsey Dam
Nelson River
0
5
10
Scale in miles

▲ Fish Camp
✱ Proposed Hydro-electric Site
⊕ Airport
⊕ Seaplane Base

MAP 4
MOOSE DENSITIES
IMPORTANT MOOSE HUNTING AREAS
WATERFOWL BREEDING & STAGING AREAS
RAT-BURNTWOOD DIVERSION - MANITOBA

LAKE WINNIPEG,
CHURCHILL AND NELSON RIVERS
STUDY BOARD
Winnipeg Manitoba

Project No. M25

F. F. SLANEY & COMPANY LIMITED
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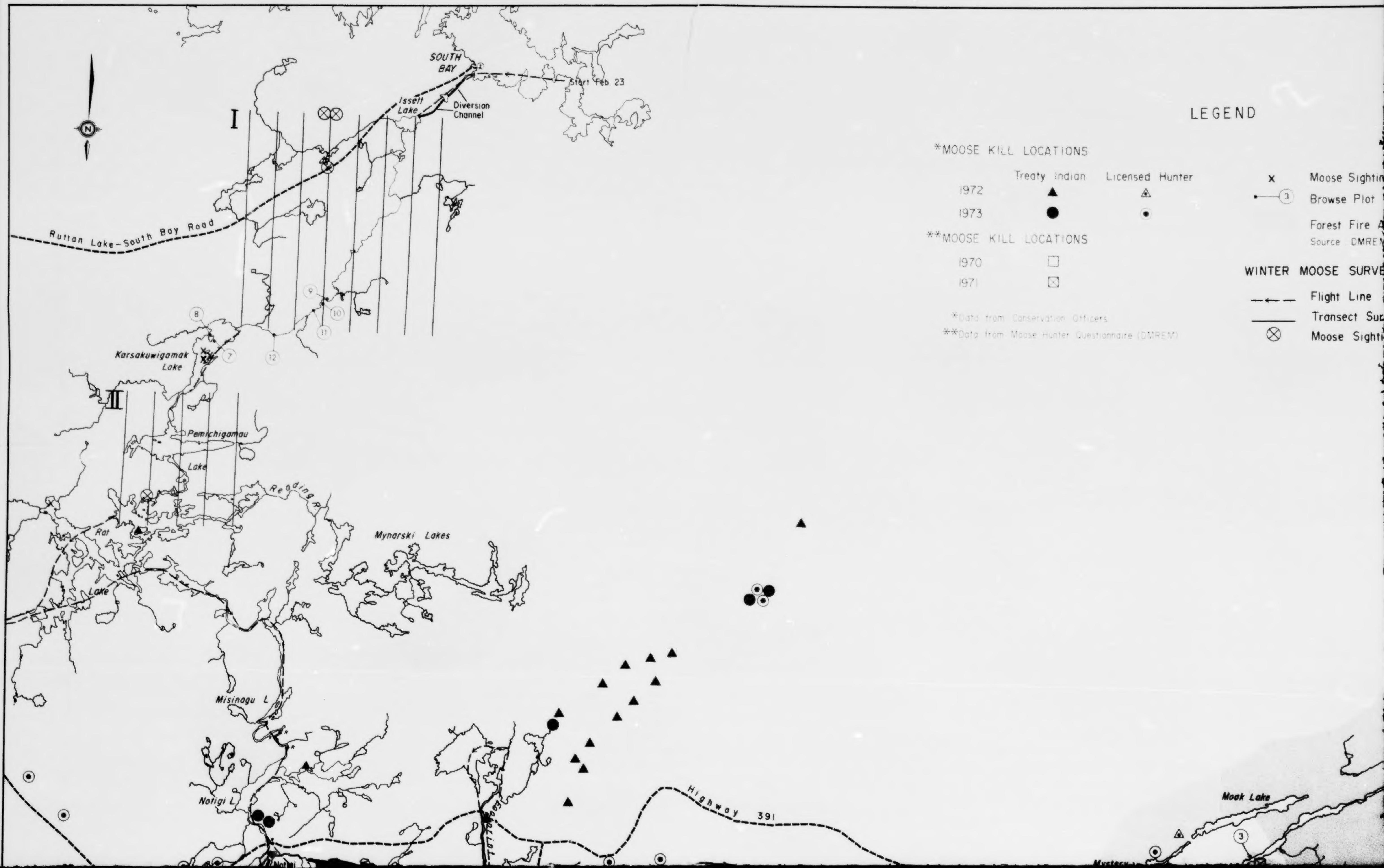
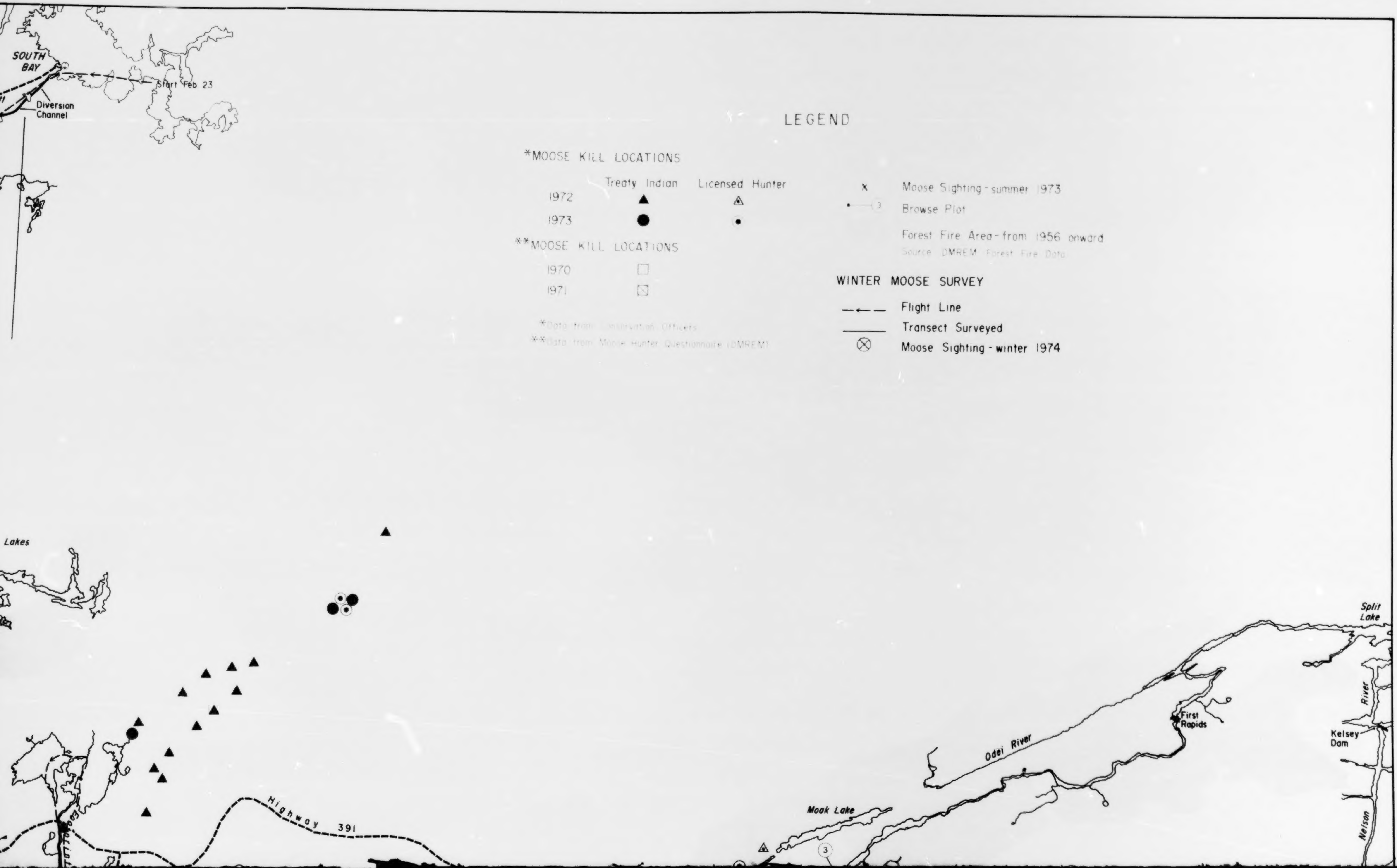
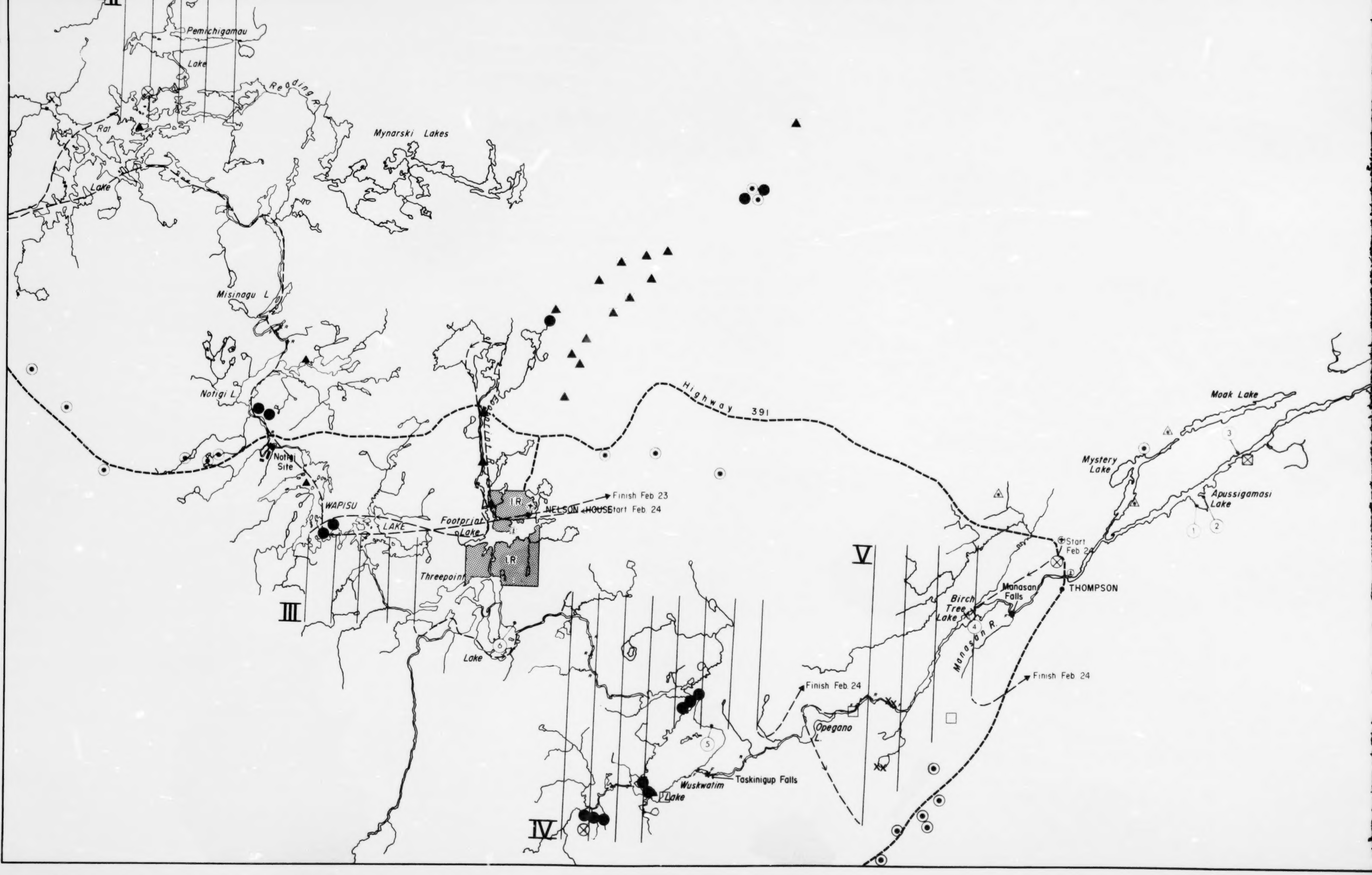
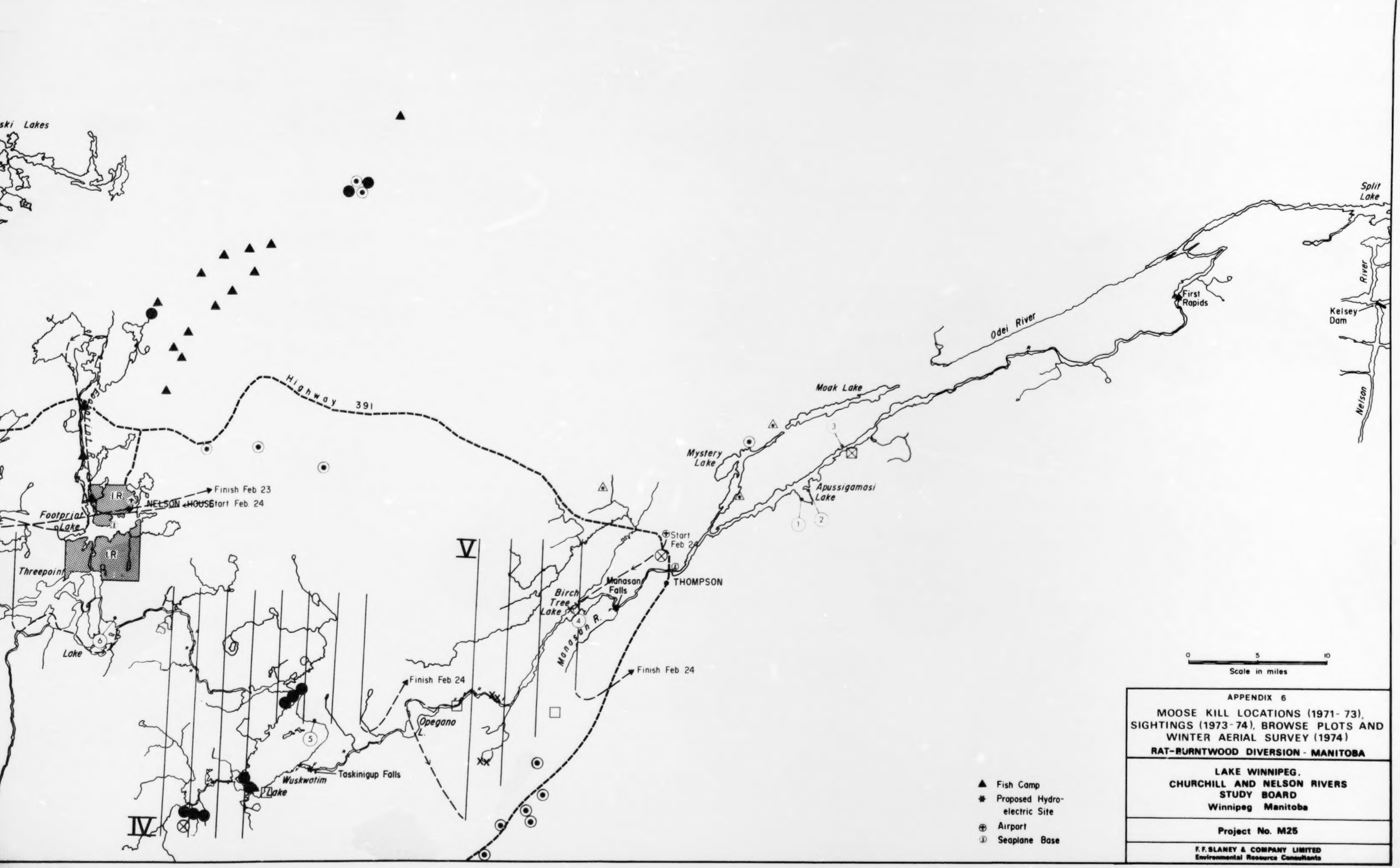

SOUTH BAY
Start Feb. 23
Issett Lake
Diversion Channel
I
II
Ruttan Lake-South Bay Road
Karsakuwigamak Lake
Pemichigamau Lake
Reading R.
Rat Lake
Mynarski Lakes
Misinagu L.
Notigi L.
Highway 391
Moak Lake
LEGEND
*MOOSE KILL LOCATIONS
Treaty Indian
Licensed Hunter
1972 ▲ ◬
1973 ● ⊙
**MOOSE KILL LOCATIONS
1970 □
1971 ⊠
*Data from Conservation Officers
**Data from Moose Hunter Questionnaire (DMREM)
x Moose Sightin
Browse Plot
Forest Fire A
Source DMREM
WINTER MOOSE SURVE
Flight Line
Transect Su
⊗ Moose Sighti


SOUTH BAY
Start Feb 23
Diversion Channel
LEGEND
*MOOSE KILL LOCATIONS
Treaty Indian
Licensed Hunter
1972 ▲ ◬
1973 ● •
**MOOSE KILL LOCATIONS
1970 ☐
1971 ⊠
*Data from Conservation Officers
**Data from Moose Hunter Questionnaire (DMREM)
× Moose Sighting - summer 1973
Browse Plot
Forest Fire Area - from 1956 onward
Source DMREM Forest Fire Data
WINTER MOOSE SURVEY
Flight Line
Transect Surveyed
⊗ Moose Sighting - winter 1974
Lakes
Highway 391
Moak Lake
3
Odei River
First Rapids
Split Lake
Kelsey Dam
Nelson River


Pemichigamau Lake
Reading R.
Rat Lake
Mynarski Lakes
Misinagu L.
Notigi L.
Notigi Site
WAPISU LAKE
Footprint Lake
I.R.
I.R.
NELSON HOUSE
Finish Feb 23
Start Feb 24
Threepoint Lake
III
IV
V
Highway 391
Moak Lake
Mystery Lake
Apussigamasi Lake
1
2
3
4
5
6
Start Feb 24
THOMPSON
Manasan Falls
Birch Tree Lake
Manasan R.
Finish Feb 24
Finish Feb 24
Opegano L.
Taskinigup Falls
Wuskwatim Lake


ski Lakes
Split Lake
River
Kelsey Dam
Nelson
First Rapids
Odei River
Moak Lake
Mystery Lake
Apussigamasi Lake
Highway 391
Finish Feb 23
NELSON HOUSE
Start Feb 24
I.R.
I.R.
Footprint Lake
Threepoint
Lake
V
IV
Start Feb 24
THOMPSON
Manasan Falls
Birch Tree Lake
Manasan R.
Finish Feb 24
Finish Feb 24
Opegano L.
Wuskwatim Lake
Taskinigup Falls
1
2
3
4
5
6
0
5
10
Scale in miles
▲ Fish Camp
✱ Proposed Hydro-electric Site
⊕ Airport
Ⓘ Seaplane Base

APPENDIX 6

MOOSE KILL LOCATIONS (1971-73), SIGHTINGS (1973-74), BROWSE PLOTS AND WINTER AERIAL SURVEY (1974)

RAT-BURNTWOOD DIVERSION - MANITOBA

LAKE WINNIPEG,
CHURCHILL AND NELSON RIVERS
STUDY BOARD
Winnipeg Manitoba

Project No. M25

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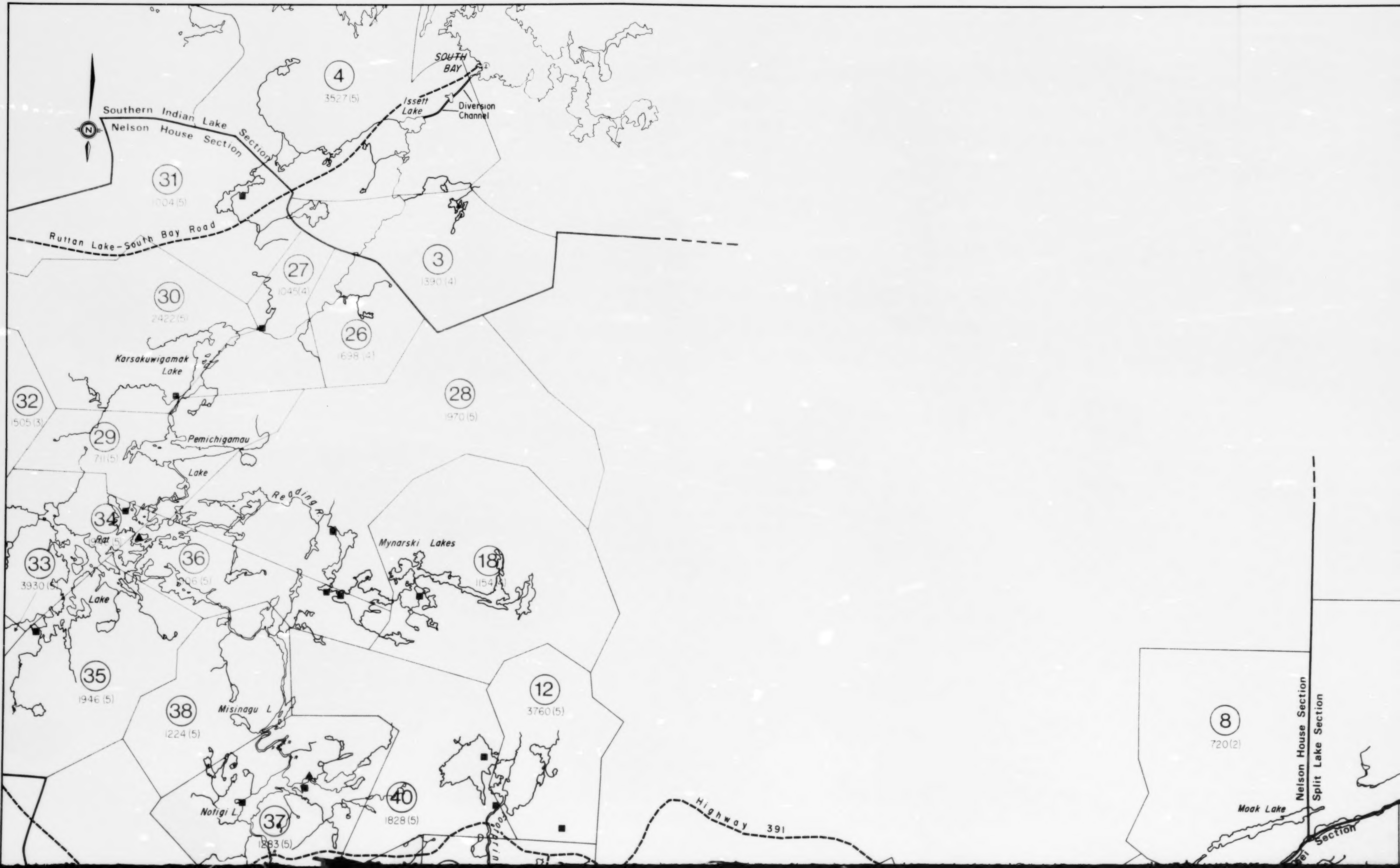
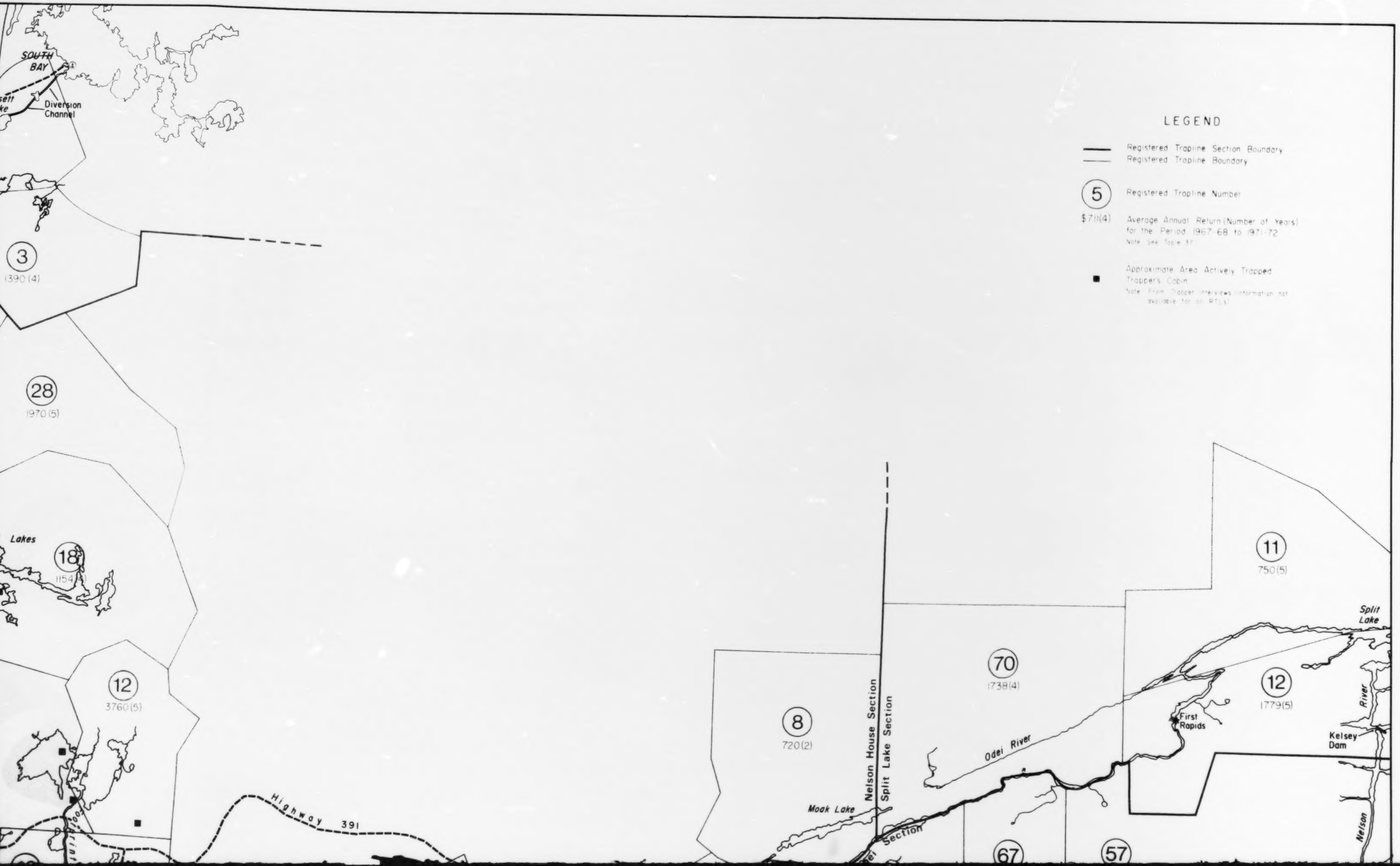
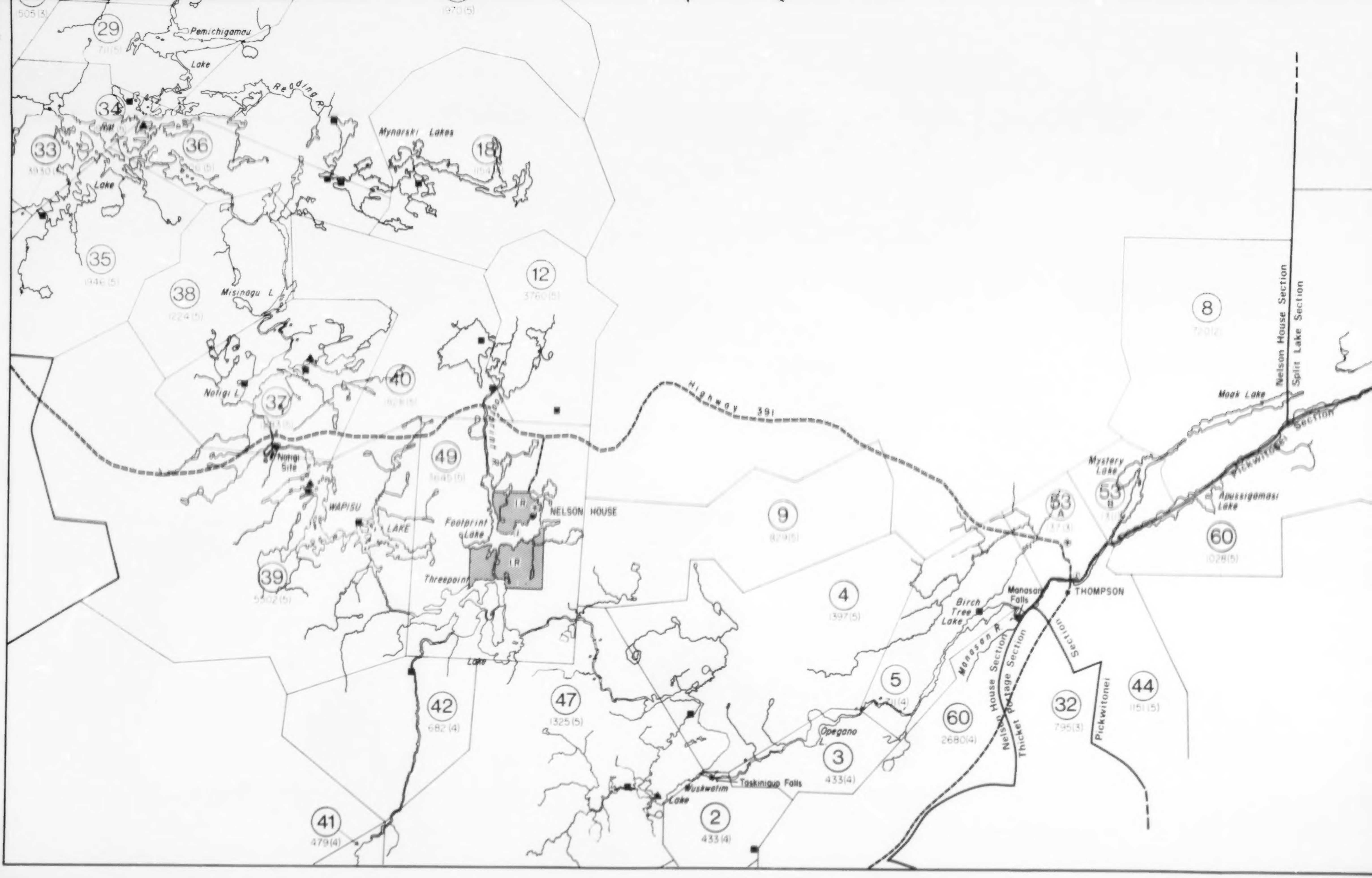
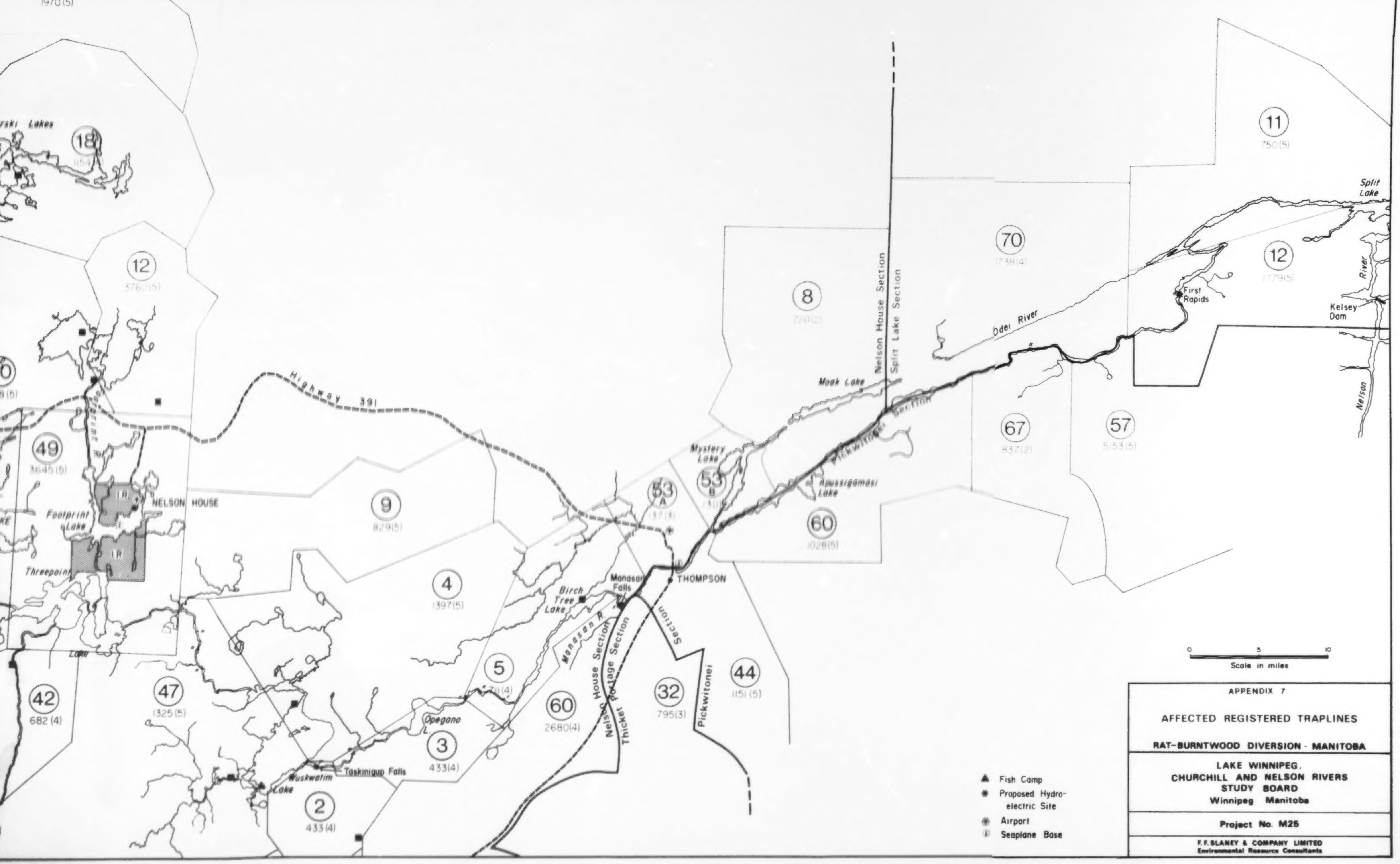

N
Southern Indian Lake Section
Nelson House Section
SOUTH BAY
Issett Lake
Diversion Channel
4
3527(5)
31
1004(5)
Ruttan Lake-South Bay Road
27
1045(4)
3
1390(4)
30
2422(5)
26
1698(4)
Karsakuwigamak Lake
28
1970(5)
32
1505(3)
29
711(5)
Pemichigamau Lake
Reading R.
34
Rat Lake
33
3930(5)
36
Mynarski Lakes
18
1154(4)
35
1946(5)
38
1224(5)
Misinagu L
12
3760(5)
8
720(2)
Nelson House Section
Split Lake Section
Notigi L
37
1283(5)
40
1828(5)
Highway 391
Moak Lake
Section


SOUTH BAY
sett
ke
Diversion Channel
3
1390 (4)
28
1970 (5)
Lakes
18
1154
12
3760 (5)
Highway 391
8
720 (2)
Moak Lake
Nelson House Section
Split Lake Section
Section
70
1738 (4)
Odei River
11
750 (5)
Split Lake
12
1779 (5)
First Rapids
Kelsey Dam
River
Nelson
67
57
LEGEND
Registered Trapline Section Boundary
Registered Trapline Boundary
5
Registered Trapline Number
$711 (4)
Average Annual Return (Number of Years) for the Period 1967-68 to 1971-72
Note: See Table 37.
Approximate Area Actively Trapped
■ Trapper's Cabin
Note: From Trapper interviews (information not available for all RTLs)


1505(3)
1970(5)
29
711(5)
Pemichigamau
Lake
Reading R.
34
Rat
33
3930
36
Lake
Mynarski Lakes
18
35
1946(5)
38
1224(5)
Misinagu L
12
3760(5)
Notigi L.
37
40
49
1645(5)
Notigi Site
WAPISU
LAKE
Footprint Lake
I.R.
I.R.
NELSON HOUSE
Threepoint
Lake
39
5502(5)
42
682(4)
47
1325(5)
41
479(4)
Highway 391
9
829(5)
4
1397(5)
5
711(4)
Opegano L.
3
433(4)
Taskinigup Falls
Wuskwatim Lake
2
433(4)
Birch Tree Lake
Manasan Falls
Manasan R.
THOMPSON
53 A
137(3)
53 B
Mystery Lake
8
720(2)
Moak Lake
Nelson House Section
Split Lake Section
Pickwitonei Section
Apussigamasi Lake
60
1028(5)
60
2680(4)
Nelson House Section
Thicket Portage Section
Pickwitonei Section
32
795(3)
44
1151(5)


1970(5)
rski Lakes
18
1154(
12
3760(5)
0
8(5)
49
3645(5)
NELSON HOUSE
Footprint Lake
IR
IR
Threepoint
KE
Lake
42
682 (4)
47
1325(5)
Highway 391
9
829(5)
4
1397(5)
5
711(4)
3
433(4)
Opegano L.
Taskinigup Falls
Wuskwatim Lake
2
433(4)
60
2680(4)
Birch Tree Lake
Manasan Falls
Manasan R.
Nelson House Section
Thicket Portage Section
THOMPSON
Pickwitonei Section
32
795(3)
44
1151(5)
53 A
137(3)
53 B
131(1)
Mystery Lake
8
720(2)
Nelson House Section
Split Lake Section
Moak Lake
Pickwitonei Section
Apussigamasi Lake
60
1028(5)
70
1738(4)
67
837(2)
57
5153(5)
11
750(5)
12
1779(5)
Odei River
First Rapids
Split Lake
Kelsey Dam
River
Nelson
0
5
10
Scale in miles
▲ Fish Camp
✱ Proposed Hydro-electric Site
● Airport
◐ Seaplane Base

APPENDIX 7

AFFECTED REGISTERED TRAPLINES

RAT–BURNTWOOD DIVERSION - MANITOBA

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